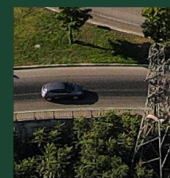
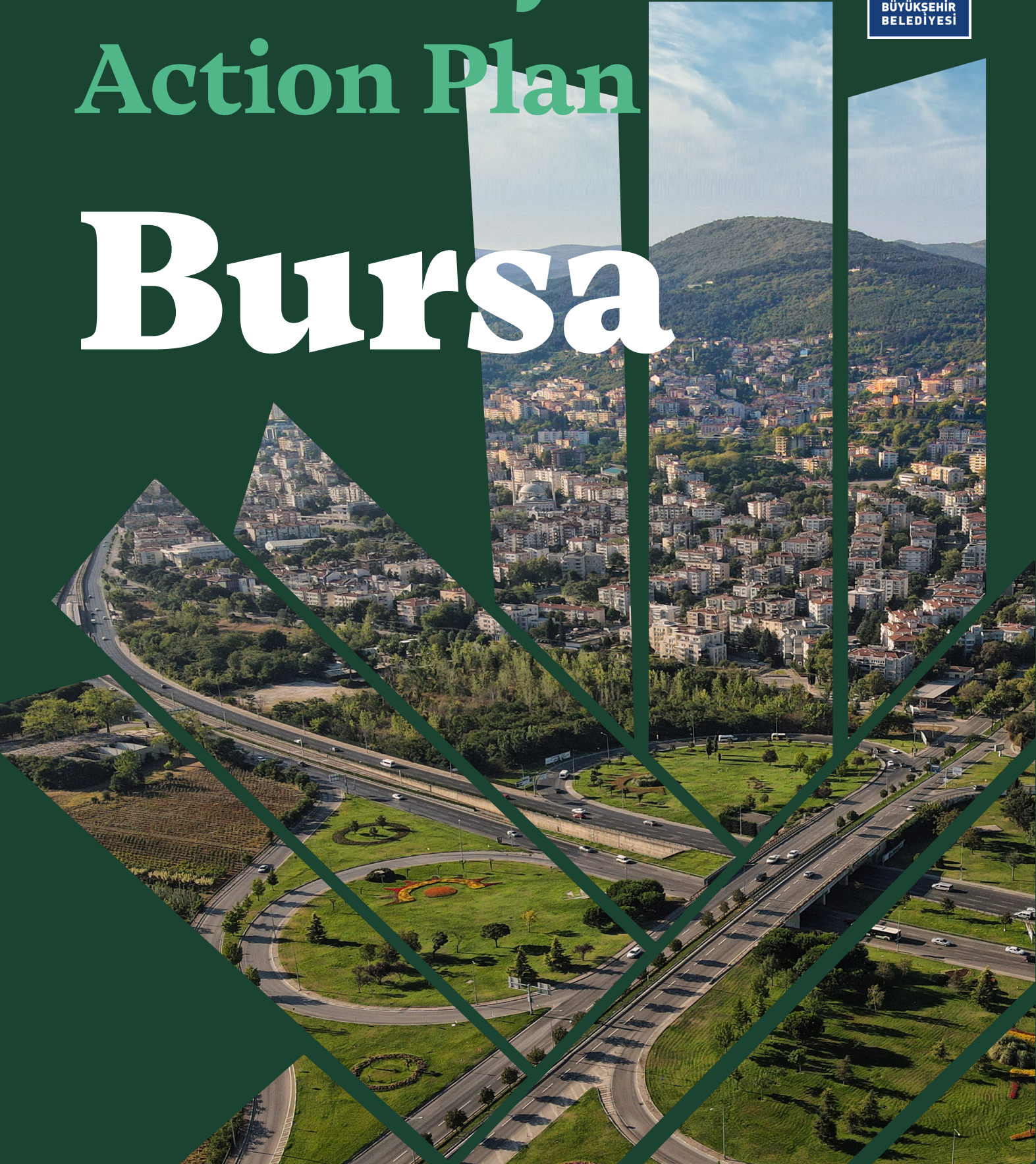


Green City Action Plan Bursa



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Foreword



Mustafa BOZBEY

Mayor of Bursa Metropolitan Municipality

For centuries, Bursa has been one of Türkiye's most exceptional cities – celebrated for its natural beauty, deep-rooted history, and enterprising people. Today, we recognise that securing our future calls for more strategic and environmentally responsible action.

Bursa Metropolitan Municipality has developed this Green City Action Plan to reinforce the environmental pillar of sustainability and to introduce ecosystem-based approaches into our urban landscape.

This plan was prepared under the European Bank for Reconstruction and Development's (EBRD) Green Cities Programme, guided by the OECD's "Pressure-State-Response" framework. Through a detailed analysis of Bursa's current environmental conditions, we identified a set of practical and achievable actions. Each has been carefully structured with clear implementation phases, timelines, financing strategies, and alignment with our strategic goals. This framework will help strengthen Bursa's resilience to environmental risks, improve resource efficiency, and support sustainable growth.

We are committed to driving comprehensive transformation across core sectors: land use, transport, energy, water, solid waste management, buildings, industry, and climate & environment. At the same time, the Green City Action Plan embraces broader themes such as social and economic inclusion, enhancement of natural capital value, and integration of smart city measures.

I would like to extend my sincere thanks to the institutions, academics, consultants, and all stakeholders who contributed to this important initiative. Step by step, we are preparing Bursa for a future that is more liveable, more sustainable, and more resilient—and we will move towards this future with determination.

Acknowledgements

This Green City Action Plan has been developed by the **Bursa Metropolitan Municipality** (BMM) with support from the **European Bank for Reconstruction and Development** (EBRD). The development of this GCAP is supported by the **Clean Technology Fund**, part of the Climate Investment Funds partnership.

The BMM GCAP Delivery Team was led by **Dr. Ahmet Cihat Kahraman** as the Green City Officer and Head of the Department for Environmental Protection and Control, and included, **Mihnet Çuha**, **Hatice Ünlü**, **Mert Karaçalı**, **Tarık Dönmez**, and **Zehra Poroy**.

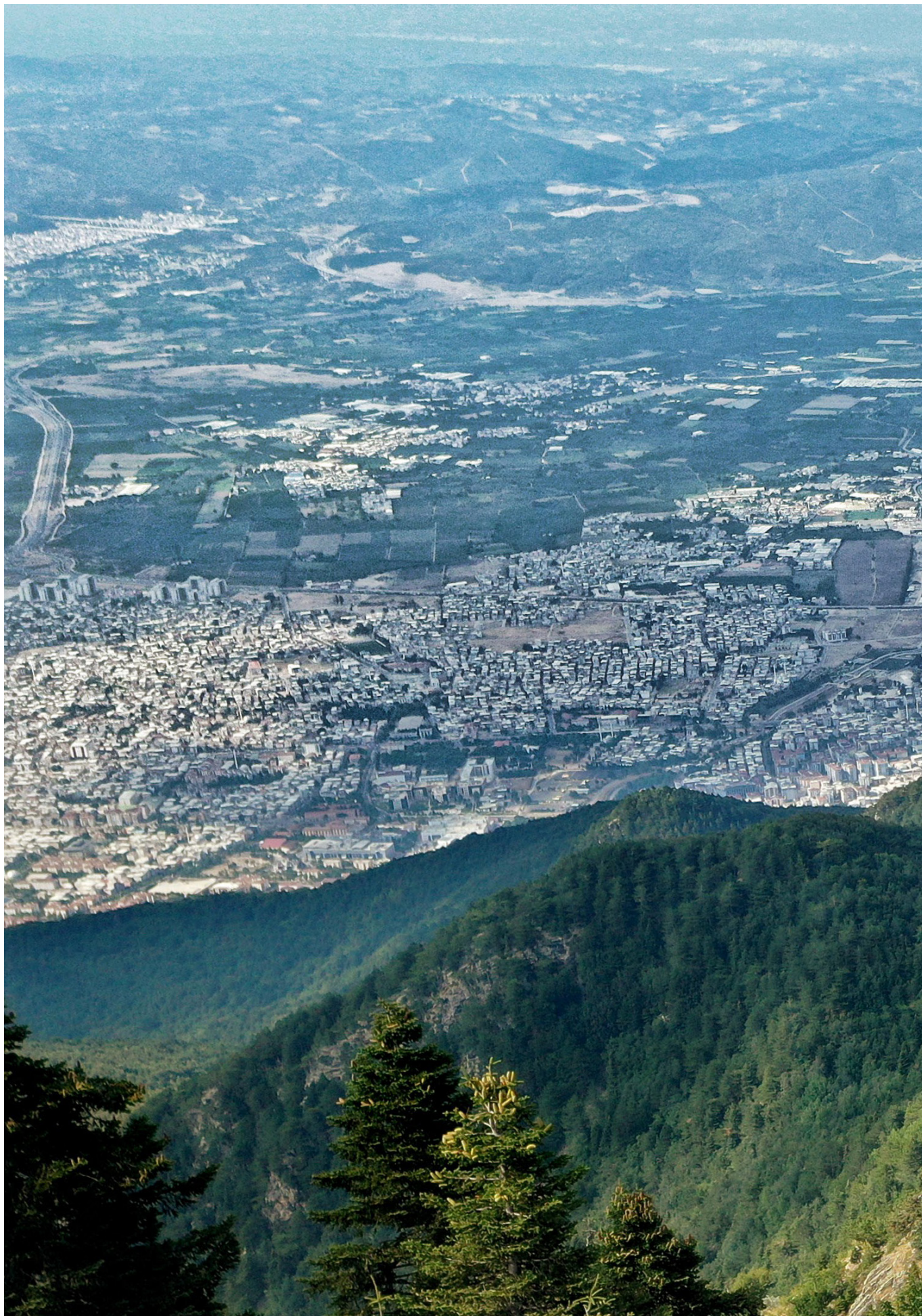
Throughout the GCAP development process, strategic guidance and advice was provided by the **GCAP Steering Committee**, comprising senior stakeholders and decision-makers from the following government, academic, and civil society organisations: **Bursa Provincial Directorate of Agriculture and Forestry**; **Bursa Eskişehir Bilecik Development Agency** (BEBKA); **Bursa Provincial Directorate of Environment, Urbanization, and Climate Change**; **Disaster and Emergency Management Presidency** (AFAD); **Uludağ Electricity Distribution Inc.** (UEDAS); **Bursa Intracity Natural Gas Distribution Inc.** (BURSAGAZ); **Bursa Water and Sewerage Administration** (BUSKI); **Bursa Transportation Public Transportation Management** (BURULAS); **Bursa City Construction and Urban Planning Information Technology Inc.** (BURKENT); **Bursa Technical University: Department of Urban and Regional Planning & Department of Environmental Engineering**; **Bursa Uludağ University: Department of Environmental Engineering**; **Bursa Chamber of Commerce and Industry** (BTSO); **The Union of Chambers of Turkish Engineers and Architects** (TMMOB), **Chamber of Environmental Engineers, Bursa Branch**.

The EBRD GCAP Coordination Team was led by **Nalân Tepe-Şençayır** as the GCAP Operational Lead and **Cem Ocağ** as the City Lead, with support from **Poyraz Saka** (Banking). Technical guidance was provided by **Emre Oguzoncul** (GCAP Technical Lead) and **Hiro Ito** (GCAP Programme Coordinator). Strategic advice and support for the delivery of this GCAP was provided by **Idil Gürsel** (Regional Head of Infrastructure Banking), **Ekaterina Miroshnik** (Director for Infrastructure, Eurasia Region), and **Lin O'Grady** (Associate Director, SI3P).

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The technical development of the Bursa GCAP was undertaken by a multidisciplinary, integrated team of urban development and infrastructure planning technical experts from **AtkinsRéalis**, a global built environment and infrastructure consultancy, and **GREEN Engineering**, a Turkish infrastructure and environmental advisory consultancy. The Consultant Team was led by **Siddharth Nadkarny** (Team Leader and Project Manager), **Özkan Hayta** (Local Project Coordinator), **Tomasz Kopczewski** (Deputy Project Manager), **Gizem Seyhan** and **Elif Erkmen** (City Coordinators), **Elif Akçay** (Stakeholder Engagement Expert), with technical advice and quality assurance reviews from **Vassiliki Kravva** (Project Director).

Sectoral technical inputs for the development of this GCAP were led by **Siddharth Nadkarny** (Land use and Buildings); **Özkan Hayta** (Transport); **David Cox** and **Engin Koç** (Buildings, Industries and Energy); **Paddy Carless** and **Elif Akçay** (Solid Waste); **Graydon Jeal** and **Prof. Dr. Ayşegül Tanık** (Water); and **Jennifer King** (Industries). Research and analytical support on all topics was provided by **Tomasz Kopczewski**, **Sahil Kanekar**, **Karen Hanyang Liu**, **Gizem Seyhan**, and **Elif Erkmen**. Technical inputs on cross-cutting topics were provided by **Ben Smith**, **Kemal Demirkol** and **Stanford Muchongwe** (Climate Adaptation and Resilience); **Eda Acara** (Gender and Economic Inclusion); **Davide Minniti** and **Viktoria Pues** (Smart Maturity); **Şahin Ekinci** (Project and Municipal Finance); **Michael Image**, **Chris North**, and **Marie-Claire Jalaguier** (Natural Capital Value); and **Freya Crunden** (GHG Emissions). The visual design and layout of the final publication were developed by **Yi-Pei Wu** from Eventual by Design Co. Ltd., based on an original concept developed by AtkinsRéalis.



Bakacak Observation Terrace, Uludağ

GREEN CITY ACTION PLAN

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GREEN CITY ACTION PLAN

ACRONYMS AND ABBREVIATIONS

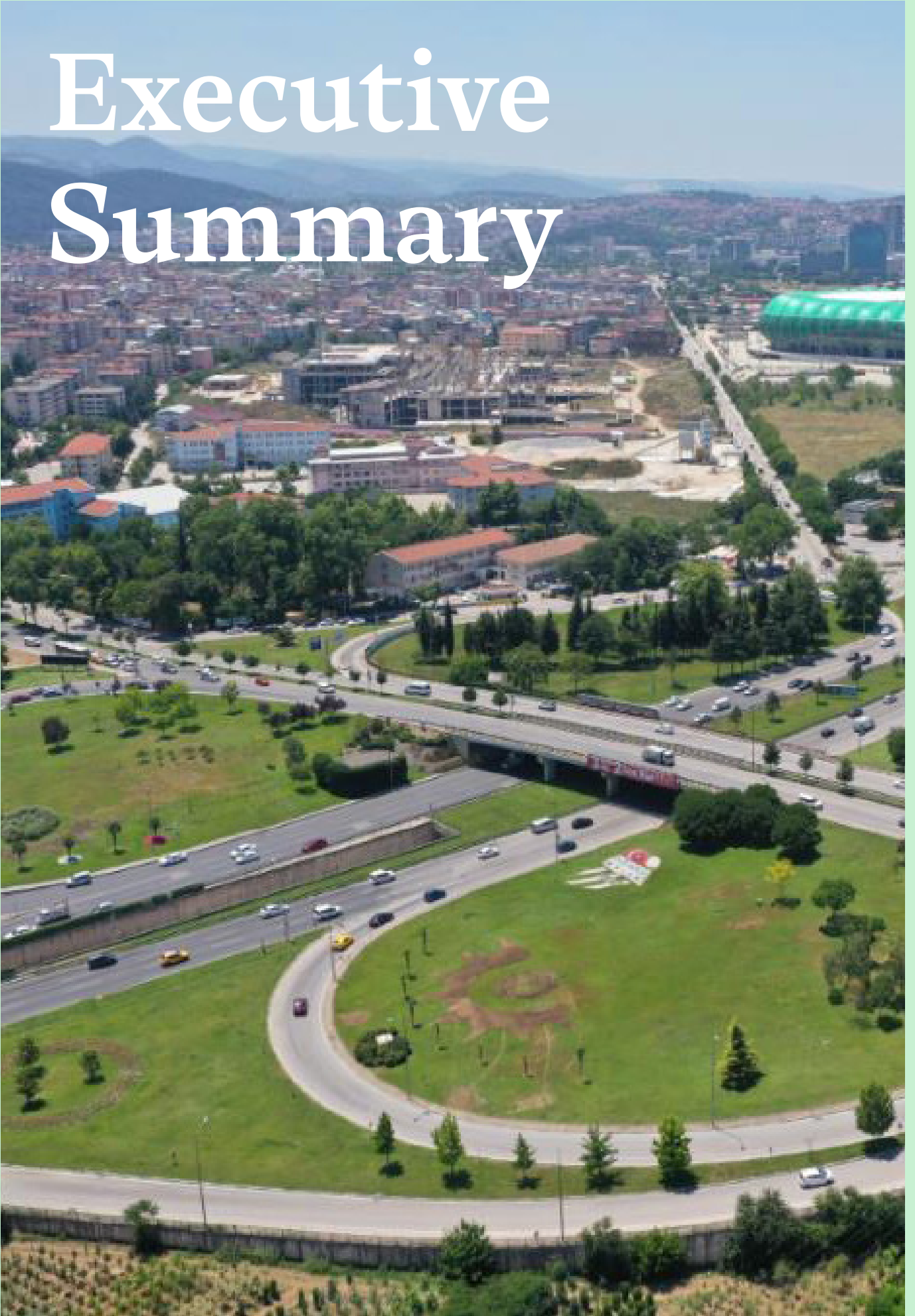
AFAD	Disaster and Emergency Management Presidency	NCV	Natural Capital Valuation
AYKOME	Infrastructure Coordination Centre	NbS	Nature-based Solutions
BAU	Business as Usual	NDC	Nationally Determined Contributions
BEBKA	Bursa Eskisehir Bilecik Development Agency	NOSAB	Nilüfer Organized Industrial Zone
BMM	Bursa Metropolitan Municipality	NRW	Non-Revenue Water
BOD	Biological Oxygen Demand	OIZ	Organized Industrial Zone
BURKENT	Bursa City Construction and Urban Planning Information Technology Inc.	OPEX	Operating Expenditure
BOSB	Bursa Organized Industrial Zone	PPP	Public-Private Partnership
BURSACAP	Bursa Climate Change Action Plan	PMP	Progress Monitoring Plan
BURULAS	Bursa Transportation Public Transportation Management	PSR	Pressure, State, Response
BUSKI	Bursa Water and Sewerage Administration	PWD	Persons with Disability
BTSO	Bursa Chamber of Commerce and Industry	SCADA	Supervisory Control and Data Acquisition
CAPEX	Capital Expenditure	SuDS	Sustainable Urban Drainage Systems
DOSAB	Demirtaş Organized Industrial Zone	TEDAS	Türkiye Electricity Distribution Corporation
DSI	State Hydraulic Works	TEIAS	Türkiye Electricity Transmission Corporation
EBRD	European Bank for Reconstruction and Development	TMP	Transport Master Plan
EEC	Energy Efficiency Centre	TRY	Turkish Lira
EIB	European Investment Bank	TÜRKSOY	International Organization of Turkic Culture
EPC	Energy Performance Certificate	UEDAS	Uludağ Electricity Distribution Corporation
EU	European Union	UN	United Nations
EUAS	Electricity Generation Incorporated Company	UNESCO	United Nations Educational, Scientific and Cultural Organization
FAR	Floor Area Ratio	WWTP	Wastewater Treatment Plant
G&EI	Gender and Economic Inclusion		
EV	Electric Vehicle		
GCAP	Green City Action Plan		
GDP	Gross Domestic Product		
GHG	Greenhouse Gas		
GIS	Geographic Information Systems		
IDB	Indicator Database		
IFI	International Financial Institution		
IMP	Implementation Monitoring Plan		
IRAP	Bursa Provincial Disaster Risk Reduction Plan		
LRT	Light Rail Transport		
MJ	Megajoule		
MSW	Municipal Solid Waste		



Bursa Atatürk House Museum, Osmangazi

GREEN CITY ACTION PLAN

Executive Summary



Acemler Junction, Osmangazi

Bursa is a thriving metropolis of 3.2 million people in Türkiye's Marmara region, with a **rich historical and cultural legacy, natural beauty, and a reputation as an industrial powerhouse**. At the same time, its climate and physical geography, historic legacy of urbanisation, and industrial development have indirectly led to significant environmental impacts including **air and water pollution, high levels of greenhouse gas emissions, loss of natural and agricultural land, and vulnerability to climate and disaster risks**.

To address the priority environmental challenges emerging from these drivers (see page ii), the **Bursa Metropolitan Municipality (BMM)** has developed this **Green City Action Plan (GCAP)**. This GCAP contains an integrated and detailed set of priority infrastructure investments, policy interventions, and capacity-building initiatives to address Bursa's environmental challenges, strengthen its climate resilience, and catalyse sustainable urban development. It serves as a **tangible demonstration of BMM's commitment to fostering a thriving future for Bursa's residents** and provides an **implementation roadmap for the city to drive sustainable and resilient urban development** over the coming decades.

This GCAP has been developed with support from the **European Bank for Reconstruction and Development (EBRD)** through EBRD Green Cities, which BMM joined in June 2023. EBRD Green Cities is EBRD's flagship urban sustainability initiative, under which it has mobilised **more than EUR 7 billion in financing to more than 50 cities to support the implementation of sustainable infrastructure projects and policy interventions**. The development of this GCAP has also been supported by the **Clean Technology Fund (CTF)**, part of the Climate Investment Funds partnership.

The GCAP is structured around eight sectors that shape the urban built environment in Bursa:



LAND USE



BUILDINGS



WATER



SOLID WASTE



INDUSTRIES



TRANSPORT



ENERGY



CLIMATE AND ENVIRONMENT

In addition to considering the interlinkages between these sectors and environmental challenges, the **GCAP also considers how these sectors interact with key cross-cutting themes like climate change, gender and economic inclusion, smart maturity, and natural capital value**. The systematic assessment of Bursa's environmental situation and development of Green City Actions was guided by EBRD's Green City Action Plan Methodology, carefully adapted to Bursa's environmental, governance, and urban development context.

PRIORITY ENVIRONMENTAL CHALLENGES FOR BURSA

LAND USE

- Loss of agricultural land, natural areas and green space near urban core and industrial areas
- Proximity of industrial zones to residential locations with resulting impacts on quality of life and environment
- Lack of alignment between plans at different scales
- Non-compliant or unauthorised housing developments

BUILDINGS

- Lack of a detailed digital inventory of existing and planned building stock
- Lack of periodic inspections and monitoring of possible physical changes during the life cycle of buildings
- Lack of awareness and unsuitable regulations around urban transformation
- Large concentration of non-compliant / illegal construction in Osmangazi and Yıldırım districts

INDUSTRIES

- Air, water and soil pollution due to industrial activity
- High levels of resource consumption (mainly water)
- Inadequate organic waste management and recycling

TRANSPORT

- Lack of lanes dedicated exclusively to public and non-motorised transit (e.g., LRT, bus and bicycle lanes)
- Lack of integration across different public transport modes
- Lack of integration and information regarding transportation network in rural areas
- Large contribution to greenhouse gas (GHG) emissions due to inefficient and highly polluting transport system

WATER

- Loss of agricultural land, natural areas and green space near urban core and industrial areas
- Proximity of industrial zones to residential locations with resulting impacts on quality of life and environment
- Lack of alignment between plans at different scales
- Non-compliant or unauthorised housing developments

ENERGY

- High electricity losses due to low efficiency in residential and industrial buildings, and aging electricity network
- Incoherent planning of future infrastructure
- Lack of energy efficiency audits in industry

SOLID WASTE

- Air, water and soil pollution due to industrial activity
- High levels of resource consumption (mainly water)
- Inadequate organic waste management and recycling

CLIMATE AND ENVIRONMENT

- Impact on air, water, and soil quality from industrial activities.
- Poor air quality due to fuel use for heating and transport, exacerbated by dense urban development.
- Difficulty in monitoring diffuse pollution, climate related hazards, discharge of partially treated wastewater, and certain air pollutants across the Province.
- Sea level and sea surface temperature rise as a result of climate change.

In 2050, Bursa is ...

**A resilient, innovative,
liveable and happy
City that implements
sustainability
principles with
common sense
and respects its
historical, cultural and
natural heritage.**

Key Features of Bursa's Green City Action Plan

Developed through a blend of deep technical expertise with local knowledge and experience

A key feature of this GCAP has been the **comprehensive, evidence-based, and consultative approach taken** to systematically assess and prioritise environmental challenges and develop detailed actions. Over the course of the development of this GCAP, stakeholder input was sought through workshops, technical meetings, online surveys, and key informant interviews and **over 1800 participants have been engaged over the 16-month process**.

At each key stage of the GCAP development process, **analysis and recommendations have been validated with technical experts from the public, private, civil society and academic sectors** in Bursa.

Development of Green City Actions in this GCAP has been guided by a Green City Vision, **co-created with senior stakeholders and decision-makers in Bursa** to ensure that it is pragmatic and grounded in the aspirations of the city. Implementation of Green City Actions will be **driven by a cross-departmental delivery team within BMM who will follow a consultative and collaborative approach**.

A pragmatic, impactful and feasible set of Green City Actions

The **32 Green City Actions**, summarised in overleaf and detailed in the Action Cards under Part B of this document, include **infrastructure investments, policy interventions, and capacity-building initiatives** that will guide Bursa along more sustainable and resilient urban development pathways. In addition to addressing priority challenges, implementing these Actions will result in **significant economic, environmental, and social co-benefits in Bursa**. Where possible, Green City Actions have sought to build on or scale up existing initiatives to ensure lessons from previous similar efforts can support smooth implementation. Responsibility for **delivering actions has been allocated to relevant sectoral departments within BMM** to ensure optimal use of technical resources and maximise alignment with other departmental initiatives. Actions have been **developed in alignment with potential financing and funding streams**. Where suitable, **revenue earning and cost saving measures have been integrated** within the design of each action.

Tangible demonstration of Bursa's commitment to a sustainable and resilient future

Collectively, Bursa's Green City Actions will **mobilise approximately EUR 2.13 billion in capital investment**, with EUR 20.6 million estimated for development and advisory support for implementation, and estimated operational costs of EUR 348.6 million for the first five years. **22 out of the 32 actions (69%) are capital investments financing tangible infrastructure interventions**, while **26 out of 32 actions (81%) are planned for full implementation within 5 years of GCAP adoption**.

Aligned with Bursa's carbon emissions reductions ambitions

For the 11 Green City Actions (35%) where data and details to quantify GHG emissions reductions are available, the **GHG emissions reductions are estimated at 663,020 tCO₂e per annum**. These savings are the equivalent of **GHG emissions generated by around 4% of Bursa's population in 2019** and can be said to contribute to **achieving 10% of GHG emissions reductions required to achieve Bursa's 2030 targets**. The actual GHG emissions reductions from implementation of the GCAP is expected to be far higher as data and detail to quantify savings from other actions becomes available. Additionally, scaling up several Green City Actions – particularly in the Buildings sector – could result in additional GHG emissions reductions.

Protecting and enhancing Bursa's natural assets

Using EBRD's Natural Capital Valuation (NCV) Approach, the impact of Green City Actions on the monetary value of natural assets and ecosystem services in Bursa was estimated. Implementing all Green City Actions is expected to result in **an annual increase of roughly EUR 34.45 million in natural capital value**, or a total increase of approximately EUR 543 million (in present value terms) over a 50-year assessment period, assuming a 6% discount rate. The largest increases in natural capital value accrue from Green City Actions in the Climate & Environment, Land Use, Water, and Transport sectors.

The 6 Green City Actions with significant nature-related components result in the **greatest increases in NCV for the global climate regulation and recreation ecosystem services**.

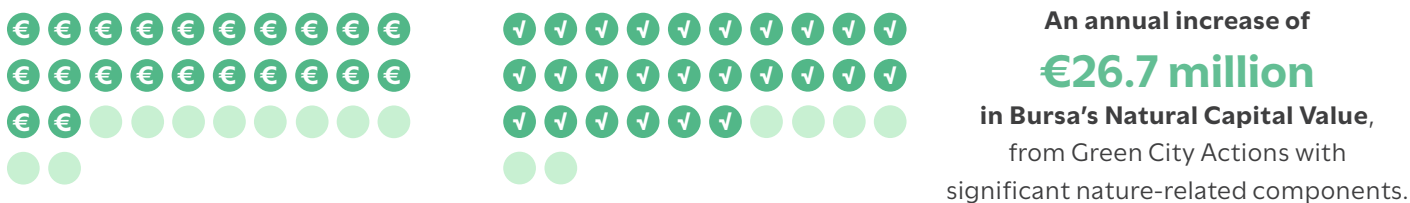
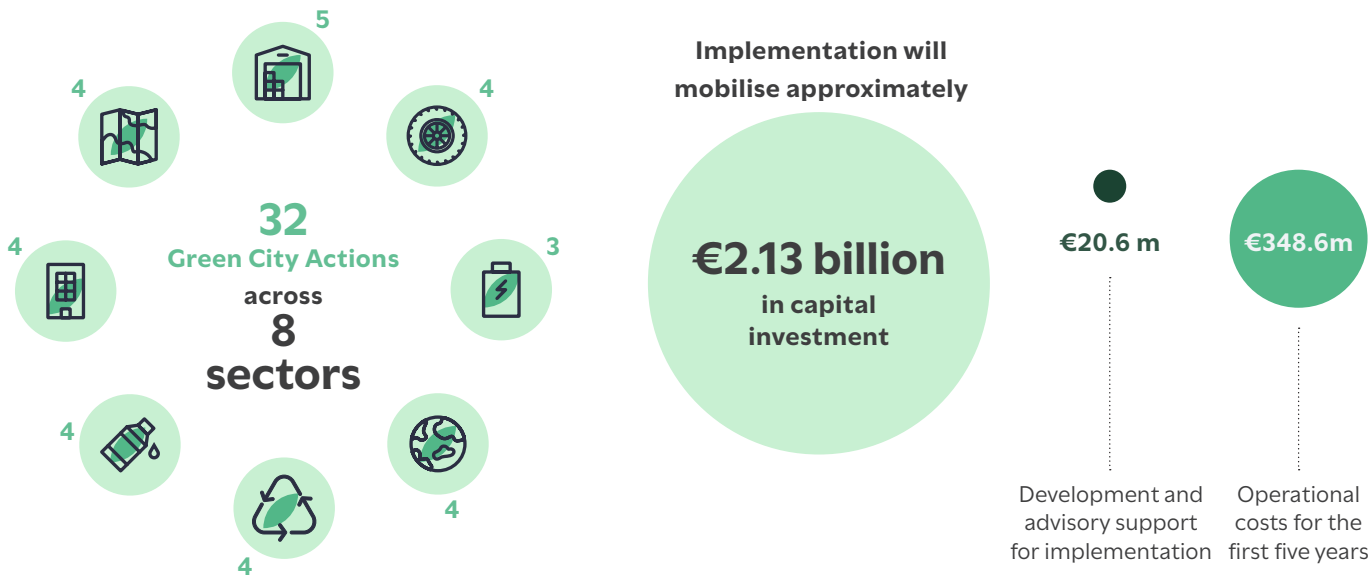
Supporting inclusive economic growth through employment opportunities

Most Green City Actions have potential for creating employment opportunities, mainly from the construction, operation, and maintenance phases of infrastructure projects, as well as the delivery of green economy services and capacity-building initiatives. It is estimated that **implementation of these actions will generate around 2,300 new employment opportunities**, particularly in the Transport, Energy, Water, and Solid Waste sectors, where large-scale infrastructure investments and service upgrades are planned for implementation. Actions **incorporate several measures to promote gender and economic inclusion** such as skill and employment development opportunities, accessibility and safety measures, and improved availability and quality of infrastructure in underserved neighbourhoods.

A collaborative approach to implementing Green City Actions

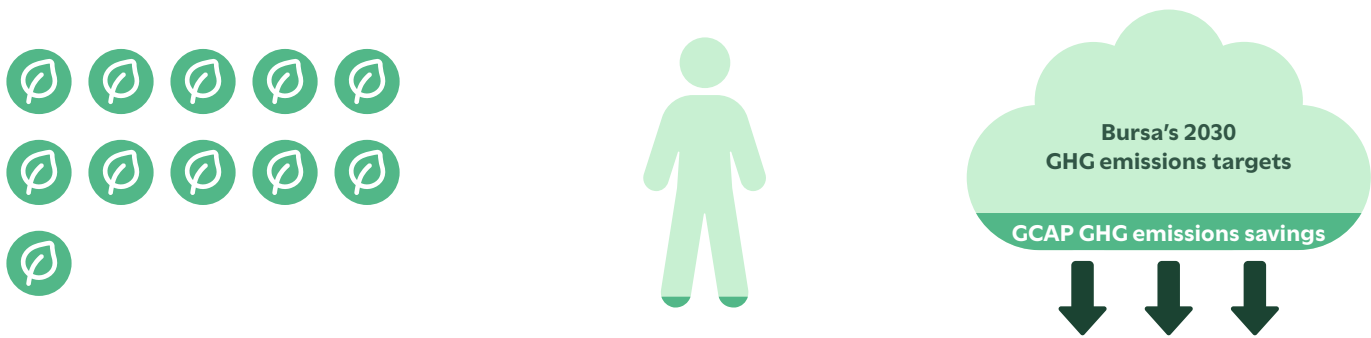
Implementation of Green City Actions will look to **sustain the collaborative approach taken in their development**. As summarised in the Implementation and Monitoring Plan that concludes this document, **implementation of the GCAP will be driven by a GCAP Delivery Team**, composed of representatives across all BMM departments designated as an Implementation Agency for various Green City Actions. **A GCAP Coordinator will act as a primary focal point** and bridge between implementation agencies to maintain momentum and lead monitoring of progress and impact. Strategic guidance for implementation will be provided by a **GCAP Implementation Steering Committee** composed of senior decision- and policy-makers across BMM, while designated **Green City Champions** from the public, private, civil society, and academic sectors will be engaged to secure buy-in for Green City Actions and provide feedback and advice during implementation of actions. Providing further support to the GCAP Coordinator, **a set of progress and impact monitoring tools** will support regular reviews of performance, promote transparency, and facilitate improvements to Green City Actions and implementation structures.

GREEN CITY ACTIONS - AT A GLANCE



An annual increase of **€26.7 million** in Bursa's Natural Capital Value, from Green City Actions with significant nature-related components.

Around **2,300 new employment opportunities** particularly in the Transport, Energy, Water, and Solid Waste sectors



Summary of Green City Actions

Legend

TIMEFRAME

Short (<2 years) Medium (2-5 years) Long (>5 years)

CO-BENEFITS¹

Direct Indirect No Impact

ACTION OWNER

To be implemented by BMM To be implemented by BMM-affiliated institution

LAND USE

01 Develop a "City Guide" Develop a comprehensive digital platform integrating various geospatial data relevant to urban planning from all sectors.	2035 TARGETS Data relevant for planning permissions is publicly available in a digitised/online format for 100% of land parcels.	TYPE Capital Investment (Project) TIMEFRAME Short	ESTIMATED COSTS² Dev + Adv N/A CAPEX €265k OPEX €50k	IMPACT Climate Resilience GHG Emissions G&EI Smart NCV
02 Develop neighbourhood-scale urban transformation strategies Develop strategies for neighbourhood-wide urban transformation initiatives, aligned with historical context and upper-scale plans.	2035 TARGETS - Per capita green space across each urban district is greater than 15 m². 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip) 100% of neighbourhoods with a designated UNESCO World Heritage Site have a council-approved Master Development Plan. - More than 50% of commercial and residential buildings have Energy Performance Certificates.	TYPE Strategy / Plan / Study TIMEFRAME Medium	ESTIMATED COSTS Dev + Adv €1m CAPEX N/A OPEX N/A	IMPACT Climate Resilience GHG Emissions G&EI Smart NCV
03 Undertake urban redevelopment along planned metro lines Implement a transit-oriented urban redevelopment project near a planned metro station.	2035 TARGETS - Per capita green space across each urban district is greater than 15 m². 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip) - Tree canopy cover in each district is greater than 20%.	TYPE Capital Investment (Project) TIMEFRAME Long	ESTIMATED COSTS Dev + Adv €600k CAPEX €429.7m OPEX €235k	IMPACT Climate Resilience GHG Emissions G&EI Smart NCV
04 Establish green belts around OIZs Implement green belts around planned OIZs in Karacabey and Nilüfer Districts to act as buffers for future residential growth.	2035 TARGETS - Per capita green space across each urban district is greater than 15 m². - GHG emissions from energy and fuel use in industries are 40% lower than 2014. - Tree canopy cover in each district is greater than 20%.	TYPE Capital Investment (Project) TIMEFRAME Medium	ESTIMATED COSTS Dev + Adv €250k CAPEX N/A OPEX N/A	IMPACT Climate Resilience GHG Emissions G&EI Smart NCV
05 Transform existing industrial area in Kestel or Gürsu Districts Relocate existing industrial facilities away from residential neighbourhoods in Kestel or Gürsu districts and convert the vacated land into green space and social infrastructure.	2035 TARGETS - Per capita green space across each urban district is greater than 15 m². 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip). - Tree canopy cover in each district is greater than 20%.	TYPE Capital Investment (Project) TIMEFRAME Long	ESTIMATED COSTS Dev + Adv €600k CAPEX €24m OPEX €1.05m	IMPACT Climate Resilience GHG Emissions G&EI Smart NCV

- 'Direct' = action directly targets positive impacts or co-benefits under the relevant cross-cutting theme, 'Indirect' = action expected to have some indirect positive impacts or co-benefits under the cross-cutting theme, 'None' = no direct or indirect positive impacts or co-benefits expected for the cross-cutting theme
- Dev + Adv = Development and advisory costs; CAPEX = Capital expenses; OPEX = Operating expenses for 5 years after implementation of the Action.



BUILDINGS

06

Develop a digital database for buildings

Establish a centralised digital database to consolidate data on building resilience and energy efficiency.



2035 TARGETS

- More than 50% of commercial and residential buildings have Energy Performance Certificates.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv N/A
CAPEX €1.17m
OPEX €50k

IMPACT

Climate Resilience ☒
GHG Emissions ☐
G&EI ☐
Smart ☒
NCV ☒

07

Enhance structural integrity and energy efficiency in new and existing buildings

Implement enhanced audit regime and incentivise retrofitting of older buildings for compliance with seismic and energy efficiency codes.



2035 TARGETS

- More than 50% of commercial and residential buildings have Energy Performance Certificates.

TYPE

Capacity-building / Awareness Programme

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €3.75m
CAPEX N/A
OPEX N/A

IMPACT

Climate Resilience ☒
GHG Emissions ☐
G&EI ☐
Smart ☒
NCV ☒

08

Implement sustainability and resilience interventions in BMM-owned buildings

Retrofit BMM-owned buildings to improve energy efficiency and serve as Resilience Hubs.



2035 TARGETS

- Energy efficiency of municipal buildings is 30% higher than 2024.
- Tree canopy cover in each district is greater than 20%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €400k
CAPEX €4.15m
OPEX €415k

IMPACT

Climate Resilience ☒
GHG Emissions ☒
G&EI ☒
Smart ☒
NCV ☒

09

Deploy a low-emissions heating programme for residential buildings

Support the installation of low-emissions heating technology in residential buildings to transition away from carbon-intensive heating.



2035 TARGETS

- There is no use of coal for household heating.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €200k
CAPEX €70m
OPEX N/A

IMPACT

Climate Resilience ☒
GHG Emissions ☒
G&EI ☒
Smart ☒
NCV ☐



INDUSTRIES

10

Develop a 'Net Zero Carbon Industries Action Plan'

Explore and develop feasible decarbonisation pathways in industrial facilities across Bursa.

2035 TARGETS

- GHG emissions from energy and fuel use in industries are 40% lower than 2014.
- At least 6 OIZs are certified as Green OIZs.

TYPE

Strategy / Plan / Study

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €1m
CAPEX N/A
OPEX N/A

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

11

Set up a 'Sustainable Industries Help Desk'

Launch a helpdesk to provide technical assistance on modernisation, decarbonisation and increasing resource efficiency of industrial facilities.

2035 TARGETS

- GHG emissions from energy and fuel use in industries are 40% lower than 2014.
- At least 6 OIZs are certified as Green OIZs.
- The proportion of industrial waste that is reused or recycled is greater than 80%.

TYPE

Capacity-building / Awareness Programme

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €50k
CAPEX N/A
OPEX €750k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

12

Develop an industrial waste recycling facility

Study different types of industrial waste produced in Bursa and explore viable pathways for their recycling, reuse, and resale.

2035 TARGETS

- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- GHG emissions from energy and fuel use in industries are 40% lower than 2014.
- The proportion of industrial waste that is reused or recycled is greater than 80%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €500k
CAPEX €10m
OPEX €1.6m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☒
Smart ☐
NCV ☐



TRANSPORT

13

Expand the metro / light rail network

Implement the planned M3 metro line and develop supporting infrastructure to maximise its usage.



2035 TARGETS

- Total length of rail system network is 131.5 km.
- Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv €5m
CAPEX €975m
OPEX €242.9m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

14

Develop micro-mobility infrastructure across Bursa

Implement additional bicycle lanes and supporting infrastructure to enable expansion and safe use of micro-mobility vehicles.



2035 TARGETS

- Total length of the bicycle network is 521 km.
- Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €225k
CAPEX €13.2m
OPEX €264k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

15

Transition to a low-emission bus fleet with supporting infrastructure

Implement a Bus Rapid Transit (BRT) route and supporting infrastructure to facilitate effective and efficient operations of a low-emissions bus fleet.



2035 TARGETS

- Low-emission buses comprise 100% of the public bus fleet.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €525k
CAPEX €80.2m
OPEX €13.3m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☒

16

Enhance operations of the transportation system through smart interventions

Setup an Integrated Traffic Management Centre and expand BursaKart coverage for all public transport modes.



2035 TARGETS

- Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €350k
CAPEX €5.75m
OPEX €550k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☒



WATER

17

Ensure sustainable water use in BMM-owned green spaces

Implement smart irrigation and alternative water systems in all BMM-owned green spaces.



2035 TARGETS

- Reuse rate of alternative water sources is greater than 15%.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €200k
CAPEX €784k
OPEX €39.2k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

18

Implement use of alternative water sources in buildings

Implement systems for rainwater harvesting and reusing alternative water resources in existing and planned municipal and public buildings.



2035 TARGETS

- Reuse rate of alternative water sources is greater than 15%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €330k
CAPEX €1.46m
OPEX €73k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

19

Ensure sustainable use of water resources in rural districts

Implement measures for reducing non-revenue water and improving efficiency of water use in rural districts.



2035 TARGETS

- Reuse rate of alternative water sources is greater than 15%.
- Non-revenue water is each district is lower than 26%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €550k
CAPEX €36.8m
OPEX €1.1m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

20

Implement planned upgrades to municipal wastewater treatment plants

Upgrade and complete the penultimate phases of existing WWTPs to enhance capacity, efficiency, and sustainability of wastewater treatment.



2035 TARGETS

- 100% of the municipal population is served by a wastewater treatment plant.
- 100% of water from municipal WWTPs and industrial areas are covered by water quality monitoring equipment.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv €750k
CAPEX €77.23m
OPEX €7.72m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐



ENERGY

21

Increase capacity within the Energy Efficiency Centre

Enhance operations of the existing Energy Efficiency Centre (EEC) to serve as a 'one-stop-shop' for advice on energy efficiency.

2035 TARGETS

- There is no use of coal for household heating.
- More than 50% of commercial and residential buildings have Energy Performance Certificates.
- Number of electricity interruptions are less than 13 per year per customer.

TYPE

Capacity-building / Awareness Programme

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	N/A
CAPEX	€100k
OPEX	€495k

IMPACT

Climate Resilience	
GHG Emissions	
G&E	
Smart	
NCV	

22

Establish a heat recovery plant and district heating network

Retrofit the Ovaakça Natural Gas Power Plant to recover heat and develop an accompanying district heating network.



2035 TARGETS

- Share of renewable energy use in total energy consumption is greater than 50%.
- There is no use of coal for household heating.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv	€500k
CAPEX	€25m
OPEX	€2.5m

IMPACT

Climate Resilience	
GHG Emissions	
G&E	
Smart	
NCV	

23

Expand biogas production capacity

Expand biogas production capacity at the existing Eastern İnegöl Integrated Solid Waste Facility.



2035 TARGETS

- Share of renewable energy use in total energy consumption is greater than 50%.
- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- The proportion of non-hazardous industrial waste that is reused or recycled is greater than 80%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv	€250k
CAPEX	€150m
OPEX	€15m

IMPACT

Climate Resilience	
GHG Emissions	
G&E	
Smart	
NCV	

24

Develop a floating solar farm

Develop a floating solar farm and assess feasibility of battery storage and similar renewable energy facilities.



2035 TARGETS

- Share of renewable energy use in total energy consumption is greater than 50%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv	€900k
CAPEX	€7.6m
OPEX	€760k

IMPACT

Climate Resilience	
GHG Emissions	
G&E	
Smart	
NCV	



SOLID WASTE

25

Improve performance through digital and governance initiatives

Implement joined-up digital and governance initiatives to improve coordination, sustainability, and efficiency in solid waste management.



2035 TARGETS

- Proportion of total waste sent to landfill is less than 65%.

TYPE

Data / Monitoring System

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	€50k
CAPEX	€115k
OPEX	€195k

IMPACT

Climate Resilience	
GHG Emissions	
G&E	
Smart	
NCV	

26

Improve waste segregation across the city

Facilitate the effective implementation of waste segregation programmes for all buildings and at strategic public open spaces.



2035 TARGETS

- Recycling rates in each district is greater than 35%.
- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- Proportion of total waste sent to landfill is less than 65%.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	€225k
CAPEX	€9.87m
OPEX	€2.47m

IMPACT

Climate Resilience	
GHG Emissions	
G&E	
Smart	
NCV	

27

Enhance capacity and efficiency of waste transfer station network

Build out planned waste transfer stations and carry out efficiency enhancements for existing transfer stations.



2035 TARGETS

- Recycling rates in each district is greater than 35%.
- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- Proportion of total waste sent to landfill is less than 65%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv	€400k
CAPEX	€1.47m
OPEX	€2.17m

IMPACT

Climate Resilience	
GHG Emissions	
G&E	
Smart	
NCV	

28

Implement the Western Regional Integrated Solid Waste Disposal Facility

Implement the planned Western Regional Integrated Solid Waste Disposal Facility and develop a transition plan for the existing Yenikent Solid Waste Landfill.



2035 TARGETS

- Recycling rates in each district is greater than 35%.
- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- Proportion of total waste sent to landfill is less than 65%.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv	€600k
CAPEX	€200.6m
OPEX	€54.35m

IMPACT

Climate Resilience	
GHG Emissions	
G&E	
Smart	
NCV	



CLIMATE & ENVIRONMENT

29



Develop a digital dashboard for air, noise, water and soil quality monitoring

Develop a digital dashboard to enhance monitoring, data sharing, and reporting of air, water, noise and soil quality pollution.

2035 TARGETS

- 100% of vehicular and industrial air pollution hotspots are covered by air quality monitoring equipment covering all particulate and gaseous pollutants.
- 100% of water from municipal WWTPs and industrial areas are covered by water quality monitoring equipment.

TYPE

Data /
Monitoring
System

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	€50k
CAPEX	€355k
OPEX	€175k

IMPACT

Climate Resilience	☐
GHG Emissions	☒
G&EI	☐
Smart	☐
NCV	☐

30



Develop a 'River Depollution Roadmap' for the Nilüfer Stream

Develop a roadmap to address water pollution and reduce impacts of urban development on Nilüfer Stream.

2035 TARGETS

- 100% of the municipal population is served by a wastewater treatment plant.
- Greater than 25% of length of channelised streams are replaced with nature-based solutions for mitigating flood risk.
- Tree canopy cover in each district is greater than 20%.

TYPE

Strategy / Plan /
Study

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	€300k
CAPEX	N/A
OPEX	N/A

IMPACT

Climate Resilience	☐
GHG Emissions	☐
G&EI	☐
Smart	☐
NCV	☐

31



Develop a Heat Action Plan

Develop a roadmap to address water pollution and reduce impacts of urban development on Nilüfer Stream.

2035 TARGETS

- Per capita green space across each urban district is greater than 15 m².
- Tree canopy cover in each district is greater than 20%.

TYPE

Strategy / Plan /
Study

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	€300k
CAPEX	N/A
OPEX	N/A

IMPACT

Climate Resilience	☐
GHG Emissions	☒
G&EI	☐
Smart	☐
NCV	☐

32



Implement Nature-Based Solutions along urban rivers

Implement a pilot project that utilises nature-based solutions to address flood risk along urban rivers and locate additional opportunities for similar interventions.

2035 TARGETS

- Per capita green space across each urban district is greater than 15 m².
- 70% of the population can access a park/ green space within 15 min (walk, cycle or public transport trip)
- 100% of the municipal population is served by a wastewater treatment plant.
- Greater than 25% of length of channelised streams are replaced with nature-based solutions for mitigating flood risk.
- Tree canopy cover in each district is greater than 20%.

TYPE

Capital
Investment
(Project)

TIMEFRAME

Medium

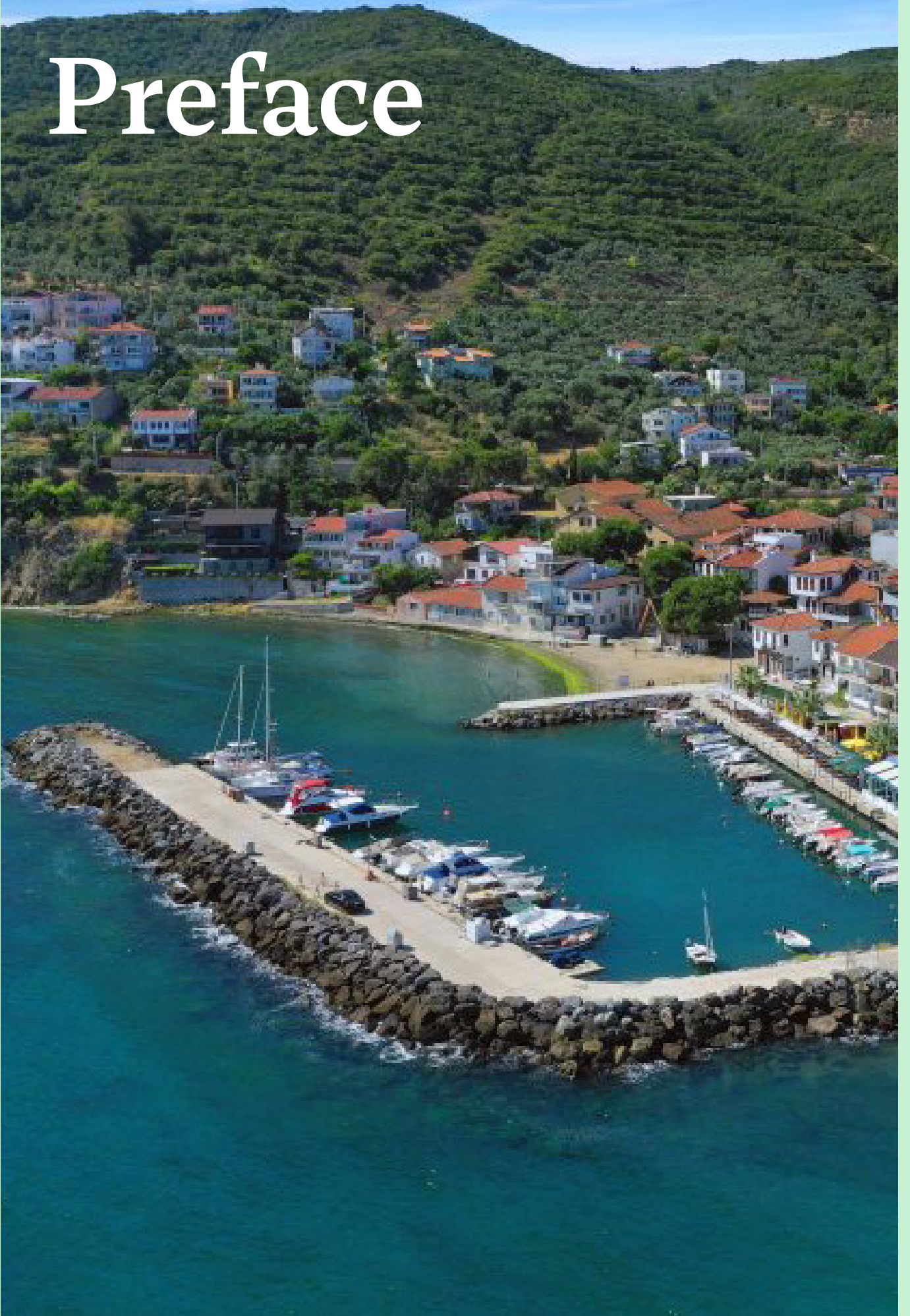
ESTIMATED COSTS

Dev + Adv	€700k
CAPEX	€3.21m
OPEX	€321k

IMPACT

Climate Resilience	☐
GHG Emissions	☐
G&EI	☐
Smart	☐
NCV	☐

Preface



Trilye, Mudanya

Bursa's Green City Action Plan provides an actionable roadmap for the Bursa Metropolitan Municipality to address environmental challenges and drive sustainable urban growth in the City. Through the implementation of the practical and impactful infrastructure and policy interventions detailed in this GCAP, Bursa will look to achieve its vision of a resilient, innovative, liveable, and happy city which thrives while respecting its historical, cultural and natural heritage.

Background

Bursa is Türkiye's fourth largest and one of its oldest cities, home to approximately 3.2 million people within its metropolitan region, of which nearly 2 million live within its urban core. Bursa's location in the economically well-developed Marmara region, access to the south-eastern coast of the Sea of Marmara, and proximity and good transport linkages to Istanbul have made it **an industrial powerhouse for Türkiye with a particularly strong automobile and textile industry**. The city has a **rich cultural legacy and historical significance** as the first capital of the Ottoman Empire. Lying at the foot of Mount Uludağ, its **natural beauty and verdant hills have earned the city the moniker of 'Yeşil Bursa' ('Green Bursa')** and made it a major tourism hub.

Bursa's **industries have driven economic development** since the establishment of its first Organised Industrial Zones (OIZs) in the 1960s. However, this industrial development is also a **key contributor to greenhouse gas (GHG) emissions and environmental pollution** in the city. The rapid population growth that accompanied this industrial development has resulted in **unplanned urban growth and a sprawling urban form**, stretching along the east-west axis of the city. **Municipal infrastructure, especially the public transport network, has not kept pace with this urban growth**, with the resulting reliance on private vehicles causing congestion and exacerbating air pollution and GHG emissions. The city's location in a semi-arid region makes it particularly vulnerable to the impacts of climate change and will likely result in **increased pressure on water resources and a higher number of extreme heat events in the future**.

To address these environmental challenges, strengthen its climate resilience, and catalyse sustainable urban development, the **Bursa Metropolitan Municipality (BMM) joined EBRD Green Cities in 2023**. EBRD Green Cities supports cities to address their key environmental challenges **by supporting investments in sustainable infrastructure and the development of suitable policy and capacity-building measures**.

A key component of EBRD's support under EBRD Green Cities is the **development of the Green City Action Plan (GCAP)**. The GCAP development process helps cities to **systematically assess and prioritise environmental challenges, and develop detailed actions** comprising sustainable infrastructure investments and policy interventions to address these challenges. A Consultant Team led by AtkinsRéalis with GREEN Engineering as the local partner has provided technical support to EBRD and BMM with the development of this GCAP. The development of this GCAP is supported by the Clean Technology Fund (CTF), part of the Climate Investment Funds partnership.

The GCAP is structured around eight sectors that shape Bursa's urban development – Land use, Buildings, Industries, Transport, Water, Energy, Solid Waste, and Climate & Environment. Following the EBRD's Green City Action Plan Methodology and using the OECD's Pressure-State-Response (PSR) Framework as a technical basis, this GCAP has been developed through **a holistic, evidence-based, and consultative approach** to assess environmental performance and prioritise environmental challenges across these eight sectors, while considering performance on **cross-cutting themes of climate change and disaster resilience, GHG emissions, Gender and Economic Inclusion (G&EI), Natural Capital Valuation (NCV), and smart maturity**. Actions for each sector have been **designed to be implemented by BMM and its affiliated institutions, in collaboration with other stakeholders** in national government departments and agencies, private sector organisations, civil society, and academic organisations.

This document is structured under two Parts:

- **Part A – Bursa Green City Action Plan**, containing the following sections:

1. Introduction to Bursa

Summarising key aspects of Bursa's geography, economy, demographics, and governance that shape its urban development.

2. Baseline Assessment

Presenting key findings from a Technical Baseline Report of Bursa's current environmental performance and the contribution of key built environment sectors – Land use, Buildings, Industries, Transport, Water, Energy, and Solid Waste – to the environmental state of the city.

3. Green City Challenges

Containing environmental and sectoral challenges in the city, were co-developed with city stakeholders who have informed the identification, shortlisting, and development of Green City Actions contained in this GCAP.

4. Green City Vision, Strategic Goals, and Targets

Articulating Bursa's ambition for its desired environmental state in 2050, areas of focus for each sector to achieve this vision, and sectoral targets to evaluate progress.

5. Green City Actions

Summarising key features, characteristics and benefits of Green City Actions, i.e., priority policy and infrastructure interventions that Bursa can implement in the next five years to address environmental challenges and achieve its vision for 2050.

6. Implementation and Monitoring

Providing key roles and responsibilities for the implementation of Green City Actions, and approaches to monitor progress and impact of these actions.

- **Part B – Action Cards**, containing detailed descriptions of the 32 Green City Actions, providing a comprehensive basis to implement infrastructure and policy interventions for a more sustainable and resilient Bursa.

GCAP Development Process

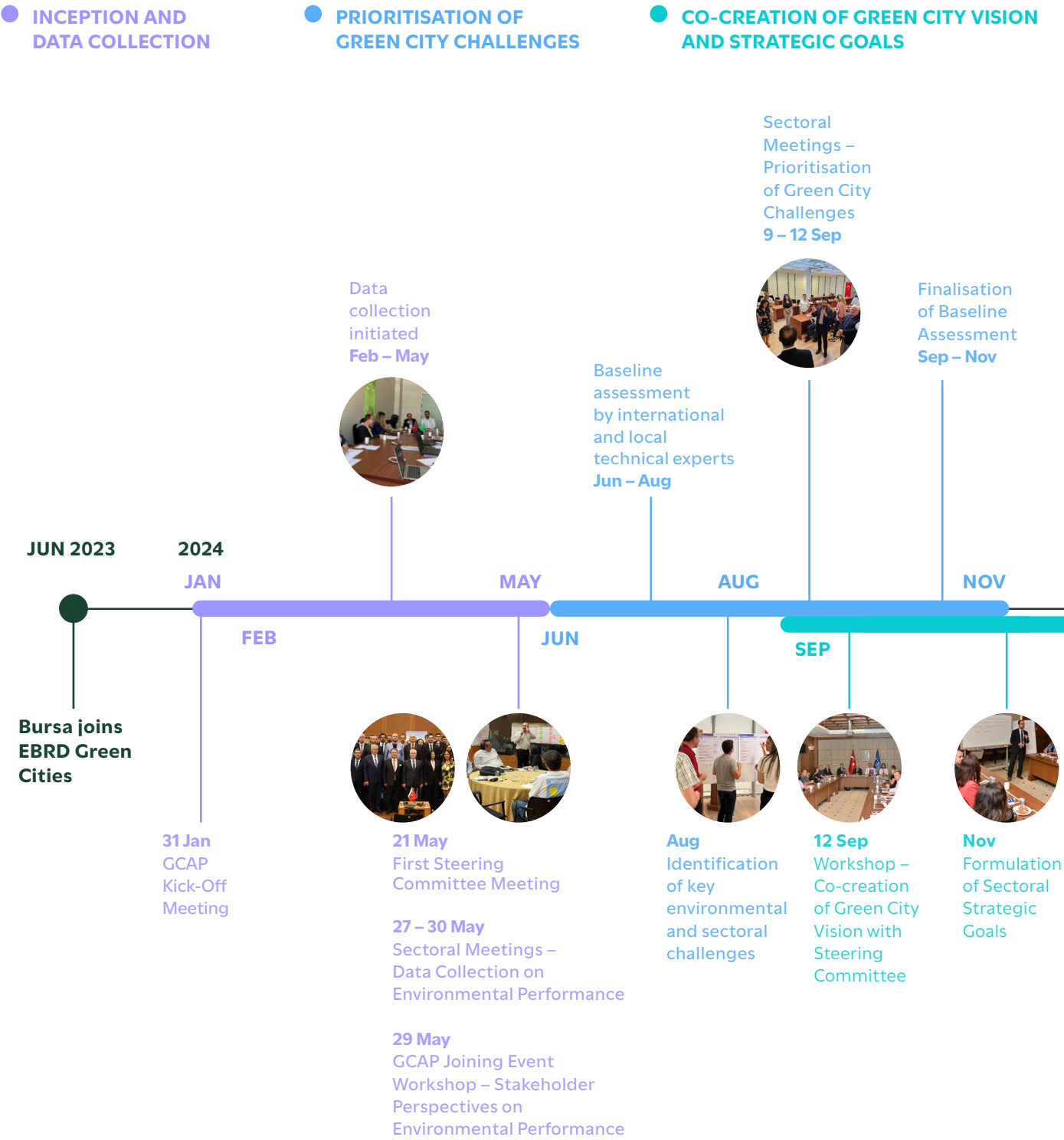
The development of Bursa's GCAP was carried out in line with EBRD's Green City Action Plan Methodology, which deploys the OECD's Pressure-State-Response (PSR) Framework to provide **a robust technical basis to systematically assess linkages between the natural environment and the built environment in a city and develop impactful and feasible actions**. Stakeholder engagement in the form of **workshops, focus groups, key informant interviews, and technical meetings with sectoral experts was carried out at critical points of the development process** to validate results from the technical assessment and ensure that the GCAP is grounded in Bursa's local context. This **evidence-based and consultative approach** to the development of the GCAP is summarised on the following pages.

Engagement Event	Date	City T/F/M	External T/F/M/P	Total
GCAP Joining Event	29 May 2024	76 / 42 / 34	70 / 47 / 23	146
Workshop - Stakeholder Perspectives on Environmental Performance	29 May 2024	62 / 28 / 34	53 / 27 / 26	115
Sectoral Meetings – Data Collection on Environmental Performance	27-30 May 2024	55 / 28 / 27	36 / 10 / 26	91
Public Survey – Green City Challenges	Jun-Jul 2024	-	1152 / 600 / 522 / 30	1,152
Sectoral Meetings – Prioritisation of Green City Challenges	9-12 Sep 2024	89 / 41 / 48	59 / 28 / 31	148
Workshop – Co-creation of Green City Vision with Steering Committee	12 Sep 2024	20 / 8 / 12	16 / 8 / 8	36
Virtual Sectoral Meetings – Shortlisting of Green City Actions	6-10 Jan, 3-7 Feb 2025	21 / - / -	43 / - / -	64
Sectoral Meetings – Finalisation of Green City Actions	20-22 May 2025	30 / 19 / 11	28 / 17 / 11	58

T - Total, F - Female, M - Male, P - Prefer not to say

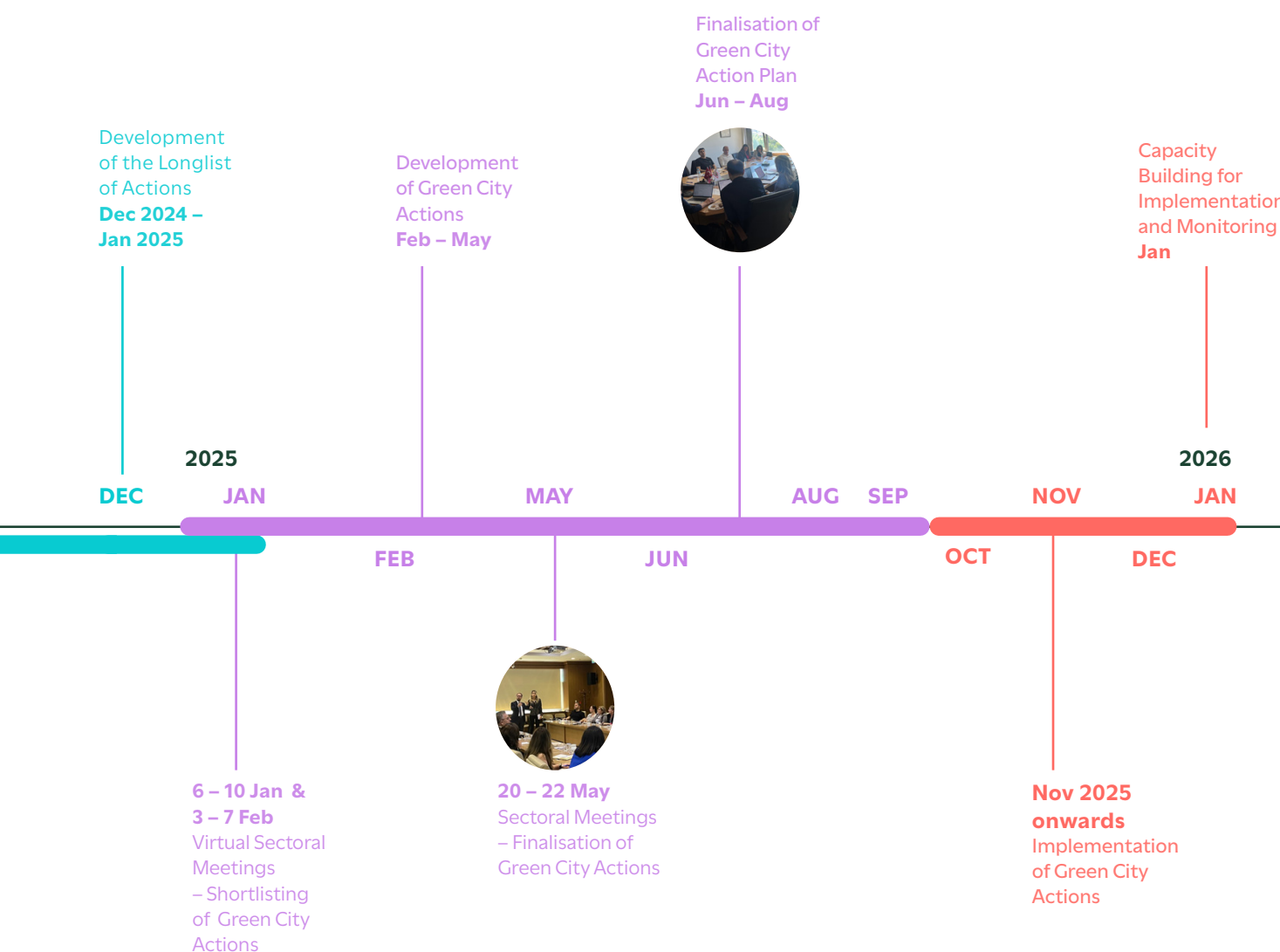
Table A1:
Participation figures at stakeholder engagement activities
Source: AtkinsRéalis analysis

Key Milestones



● DEVELOPMENT OF GREEN CITY ACTIONS

● NEXT STEPS – TOWARDS IMPLEMENTATION



NEXT STEPS – TOWARDS IMPLEMENTATION

After the completion and adoption of this GCAP, BMM will begin working collaboratively with action owners and stakeholders to implement Green City Actions. Implementation of the GCAP will be guided by the Implementation and Monitoring Plan, developed in consultation with EBRD and BMM and included under section 6 of Part A of this document. Drawing on lessons learnt from previous GCAPs, the Plan outlines a governance structure for implementation, leveraging existing technical capacity across various BMM departments to enable simultaneous delivery of multiple Green City Actions. To support tracking and reporting during the 5-year GCAP Implementation Period, BMM will utilise two tools – the Progress Monitoring Plan and the Impact Monitoring Plan. Six months after the commencement of implementation, BMM will be provided with capacity-building support in the form of training sessions and action implementation ‘surgeries’ to help unblock any technical, resource, or operational barriers for effective implementation of Green City Actions.

INCEPTION AND DATA COLLECTION

The **GCAP development process was initiated on 31 January 2024, with a Kick-Off Meeting** between BMM, EBRD, and the Consultant Team. Over the subsequent weeks, the BMM Focal Points and the Consultant Team worked in close collaboration to **identify and collect key documents** to inform subsequent stages of the process and **identify key stakeholders to be engaged throughout the process**. Sources of data were identified, and data collection was initiated with the aim of completing EBRD's Indicator Database by the end of this phase. The first Steering Committee Meeting was held on the 21 May 2024 and introduced the GCAP Development Process to the Committee Members and provided a platform to resolve any unanswered questions.

A key activity in this stage was the **GCAP Joining Event, held on 29 May 2024**. This event marked the official start of GCAP development and created awareness amongst stakeholders to support the process. Nearly 150 people attended the Joining Event, including stakeholders from the public, private, civil society, and academic sectors. Following the Joining Event, **the First Stakeholder Engagement Workshop** was conducted to gather initial perspectives on environmental topics from a cross-section of Bursa's residents that could serve as another data source to inform the baseline technical assessment. 115 attendees across 10 breakout groups participated in two workshop exercises to provide their views on sectoral performance and key environmental challenges in the city.

In the same week as the First Stakeholder Engagement Workshop, a series of **Sectoral Meetings with expert stakeholders from Bursa** were held to complement the initial results from the Workshop. These in-depth discussions involved 91 participants across seven meetings and focused on understanding key challenges and opportunities in the sector, ongoing or upcoming projects, and addressing any data gaps or questions emerging from data collection. The inception stage thus provided an optimal launchpad for the Baseline Assessment stage of the process.

PRIORITISATION OF GREEN CITY CHALLENGES

Based on the qualitative and quantitative data collected during the inception stage of the process, **international and local technical experts from the Consultant Team carried out a technical assessment of the environmental and urban development context** in Bursa, which is summarised in sections 1 and 2 under Part A.

The technical assessment encompassed a wide range of topics, including an evaluation of the policy landscape, sectoral and environmental performance, and critical cross-cutting themes such as climate change, social inclusion, and smart maturity. The assessment included a **desk-based assessment of publicly available literature and key plans, strategies and other sectoral documents** provided by BMM, along with an analysis of **quantitative indicator data** collected in EBRD's Indicator Database to assess year-on-year trends. In addition to the stakeholder perspectives obtained at workshops and technical meetings during the inception phase, views on environmental challenges were gathered from more than 1100 Bursa residents through an online survey – these **stakeholder perspectives were used to validate emerging findings from the technical assessment** and address any questions or topics where quantitative data was not sufficient.

Based on this comprehensive assessment, **key challenges and action areas for infrastructure and policy interventions were identified across eight sectors** – Land use, Buildings, Industries, Transport, Water, Energy, Solid Waste, and Climate & Environment. These challenges and action areas were **validated at eight in-person Sectoral Meetings** in Bursa, which brought together **nearly 150 representatives** from civil society organisations, academic organisations, and senior staff from various BMM departments and utility companies. Through voting and discussions at each sectoral meeting, **participants collectively prioritised Bursa's Green City Challenges**, summarised in section 3 under Part A of this document.

CO-CREATION OF GREEN CITY VISION AND STRATEGIC GOALS

A **Co-creation Workshop with the GCAP Steering Committee was organised on 12 September 2024 to develop a Green City Vision that could guide the development of Green City Actions**. Activities at the Co-creation Workshop – attended by 36 participants – were informed by the prioritised challenges and action areas agreed at Sectoral Meetings earlier in the week. After jointly **reviewing visions from other strategic documents relevant to urban development in Bursa**, participants were asked to **share key concepts, ideas or themes** that could be included in the Green City Vision through an interactive online polling tool. A **final Green City Vision was then co-created with workshop participants** after considering and fine-tuning draft Visions.

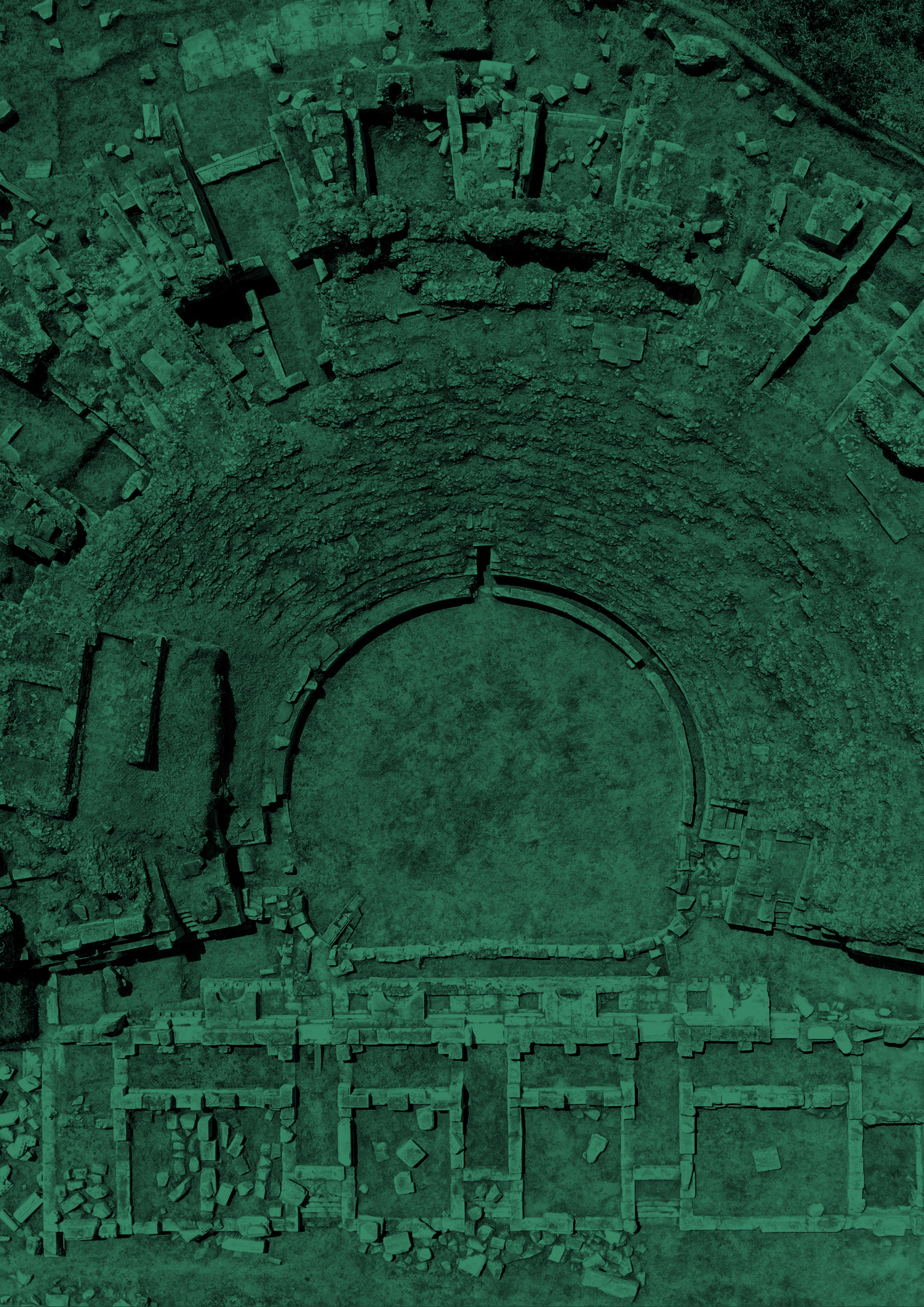
Based on the prioritised challenges and Green City Vision, **two Strategic Goals for each of the GCAP sectors** were developed, defining the areas that each sector should focus on over the next 10-15 years to achieve the Green City Vision. For each sector, **one Strategic Goal provides an area of focus for infrastructure investments in the GCAP, and one provides an area of focus for policy interventions**. In line with the Strategic Goals, 2-3 **Targets were developed for each sector**, defining a quantitative benchmark of performance that each sector is expected to meet in 2035. The Green City Vision, sectoral Strategic Goals and Targets are summarised in section 4 under Part A of this document.

DEVELOPMENT OF GREEN CITY ACTIONS

Thereafter, **a longlist of 116 actions (approximately 12-15 actions per sector) that could address the prioritised challenges and help achieve Strategic Goals** was developed for further evaluation and consideration for inclusion in the GCAP.

The 10-15 actions in each sectoral longlist were evaluated by international and local technical experts from the Consultant Team against a multi-criteria assessment framework, to determine **the potential impact and feasibility of implementation** of each action. The evaluation also assessed the **potential contribution of each action to socio-economic and environmental co-benefits**. Informed by this evaluation, technical experts selected a **preliminary shortlist of 3-5 actions for each sector** that had the highest potential for impact and could begin implementation within the 5-year GCAP implementation period. Through sectoral virtual meetings, the **preliminary shortlist for each sector was validated with technical experts from EBRD and stakeholders from Bursa** to fine-tune and select the final shortlist. Shortlisting meetings were attended **by more than 60 participants from the public, private, civil society and academic sectors** in Bursa – **including representatives from various BMM departments identified as potential action owners**. Following the virtual shortlisting meetings, a total of 32 actions across 8 sectors were selected for further development as Green City Actions.

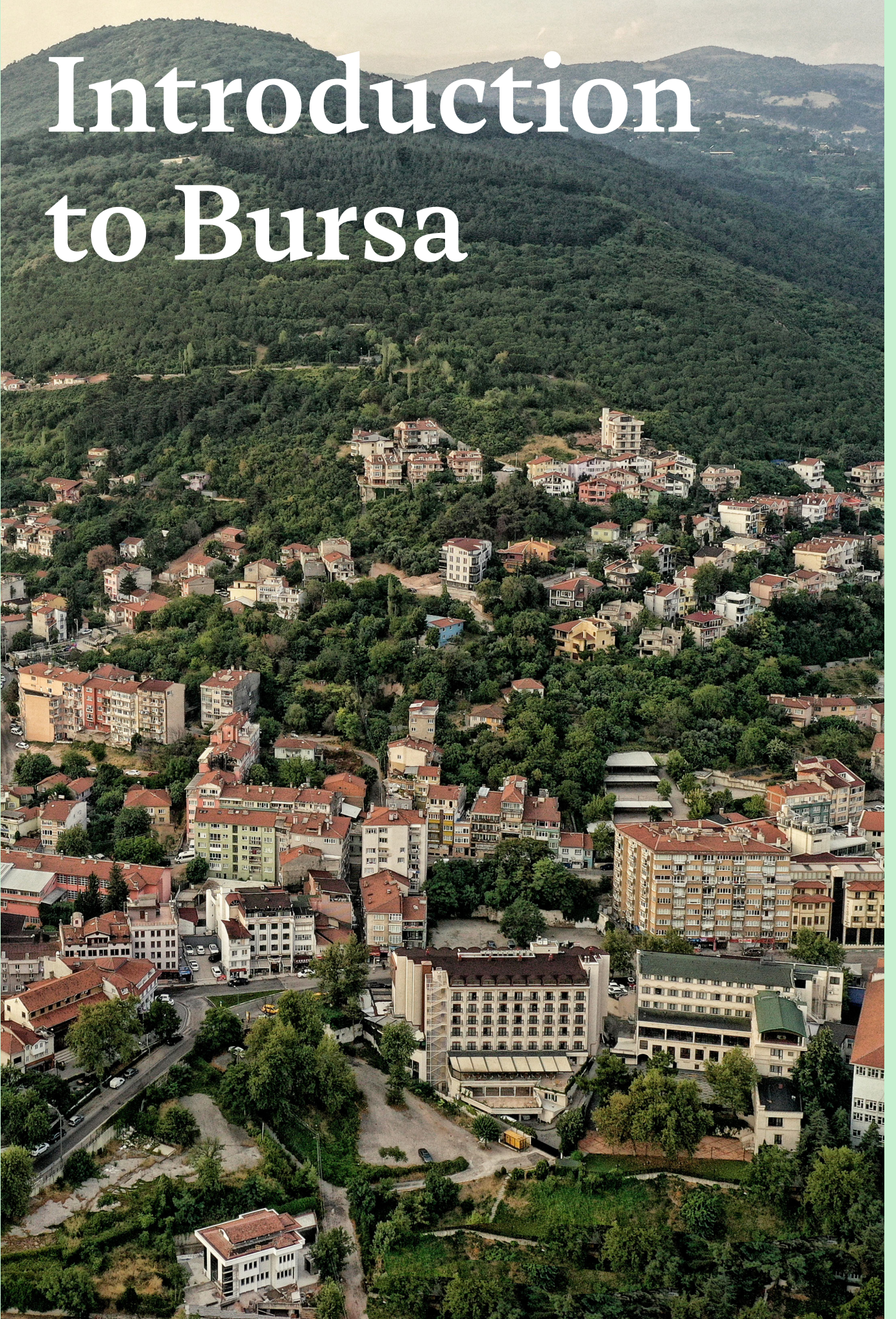
Technical experts from the Consultant Team then developed 'Action Cards' for each of the 32 Green City Actions, providing **further details on action components, implementation steps and timelines, stakeholders, expected benefits and impacts, costs and financing approaches, and contribution to Sectoral Targets**. These Action Cards were **reviewed with potential action owners across BMM departments at in-person Sectoral Meetings** to validate details and ensure alignment with other departmental initiatives. Summary information about Green City Actions is included in section 5 of Part A, and detailed write-ups for Green City Actions are included in Part B of this document.



PART A

Bursa Green City Action Plan

Introduction to Bursa



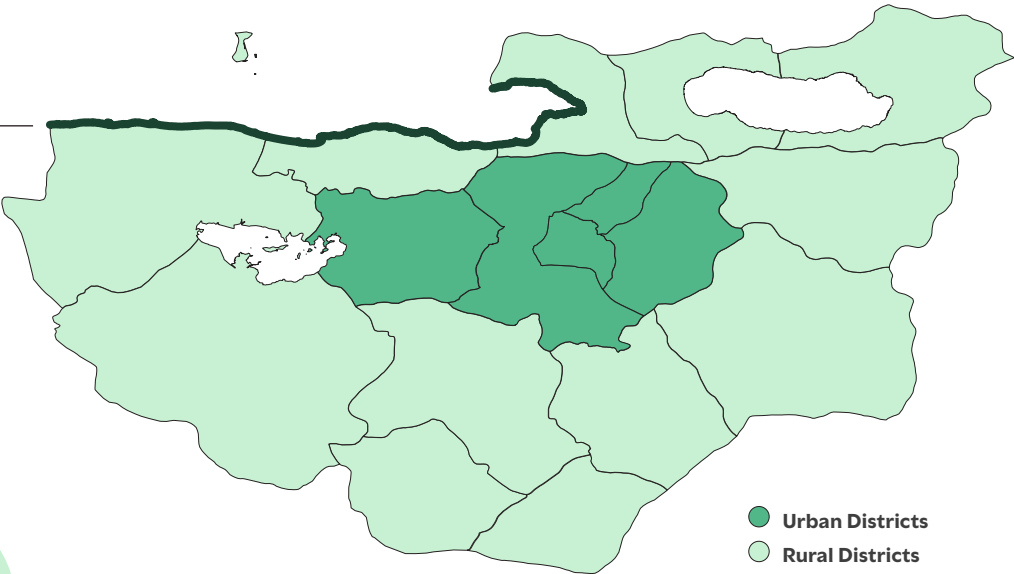
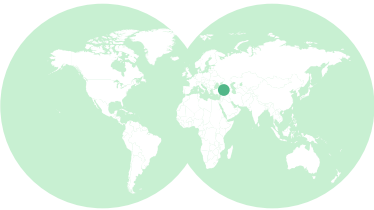
Çekirge Thermal Hotels Area, Osmangazi

Bursa's location in the **economically well-developed Marmara region**, access to the **south-eastern coast of the Sea of Marmara**, and **proximity and good transport linkages to Istanbul** have made it an **industrial powerhouse and a magnet for internal migration**. Urban infrastructure has not kept pace with this rapid industrial and population growth, leading to **significant environmental challenges and increased GHG emissions**. Additionally, Bursa's geographic and climatic context make it **more vulnerable to geophysical hazards and the impacts of climate change**.

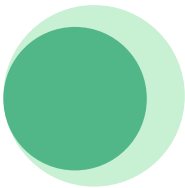
135 km
long coastline

along the Sea of Marmara

Land area of
10,882 km²



Respectively, the Province's land area comprises



2 million urban
residents

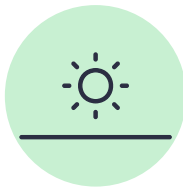
out of a total population of
3.2 million (2023)



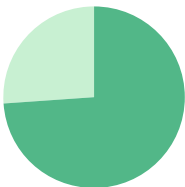
40%
Mountains



30%
plateaus



26%
plains



Over 2 million
tourists

visited Bursa in 2022, 74% of
whom are domestic tourists



Per capita
open space
is above national
standards at
12 m²



Manufacturing
and industries
account for
64% of city's GDP;
Bursa has the highest number of
OIZs (17) in the country

City Context

GEOGRAPHY

Strategically situated on the southeastern shore of the Sea of Marmara with a link to Istanbul, **Bursa Province is spread across an area of 10,882 km² with a mix of urban and rural uses.** According to the Bursa Province Disaster Risk Reduction Plan², the surface area is **nearly evenly split between mountain ranges, plateaus, and plains**, covering approximately 40%, 30%, and 26% of the Province, respectively. The region is known for its **large farms, most notably olive groves close to the Sea of Marmara, and expansive pasture areas in the Karacabey and Mustafakemalpaşa plains.**

The dominant **north-to-south wind direction in Bursa plays a role in exacerbating air pollution.** The urban core of Bursa Province is located at the northern foothills of the Uludağ Mountains on the windward side, with the industrial areas situated further north of these urban areas towards the coast. This geographic positioning worsens air pollution, especially during the winter season when the pollutants carried from northern winds accumulate at the foothills within the urban core.

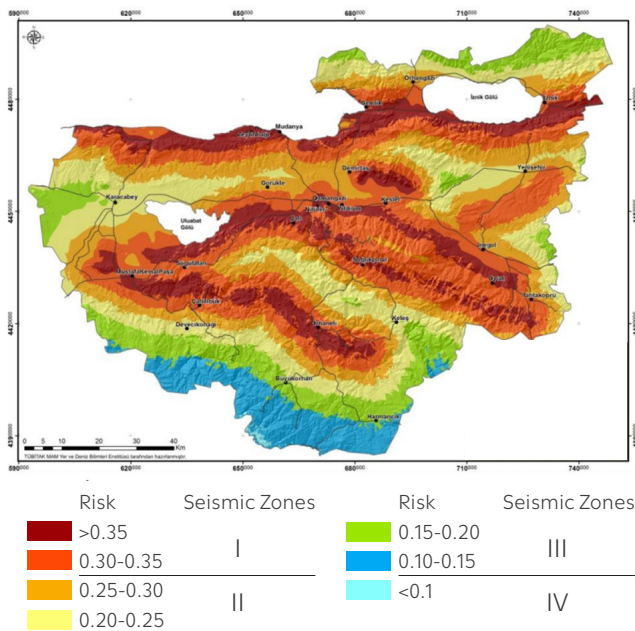


Figure A1: Map of seismic risk across Bursa.

Source: Bursa Provincial Disaster Risk Reduction Plan (IRAP)³

The Bursa Metropolitan Municipality's (BMM) administrative remit extends **across 135 km of coastline along the Sea of Marmara.** The Province also **spans three different river basins – the Marmara, Susurluk and Sakarya basins.** Several rivers and streams flowing through Bursa feed into the sea, **including Nilüfer and Karsak streams.** These streams are **often polluted due to the discharge of partially treated domestic and industrial wastewater**, which contributes to pollution in the Sea of Marmara. Activities in the agricultural and industrial sectors lead to pollution of surface and groundwater, and impact soil quality as well.

The city's geological and geomorphological structure results in its **significant vulnerability to natural disasters, with risk from earthquakes, landslides, rockfalls and potentially tsunamis**⁴. Bursa sits on the Northern Anatolian tectonic plate and thus lies in an area with major active fault lines (Figure A1), making it particularly prone to large, devastating earthquakes. Bursa experiences **landslides across its districts, and earthquakes contribute significantly to the occurrence of this hazard.** The city's low-income settlements are particularly at risk from seismic hazards due to high population density, vulnerable building stock and limited open spaces. Many of these buildings are vulnerable to earthquakes as they were often constructed before the introduction of anti-seismic standards. The frequent issuance of **building permissions** in vulnerable areas has also been observed, further **exacerbating the risk of flooding and seismic movements in urban areas.**

3. AFAD, Bursa Provincial Disaster Risk Reduction Plan, (2021).

4. AFAD, Bursa Provincial Disaster Risk Reduction Plan, (2021), available at: <https://bursa.afad.gov.tr/kurumlar/bursa.afad/Bursa-IRAPpdf>

5. AYDIN, M., 2016. Natural disasters in Türkiye and natural disaster profile of Bursa. International Journal of Social Sciences, Humanities and Education, 3(4), pp.1-10.

URBAN FORM

The **Sultan Complexes of the Ottoman Empire, built in Bursa during the 14th and 15th centuries**, acted as an anchor for residential and commercial development and determined the **main east-west transportation axis** that still guides the city's development. The main historic housing texture preserved to this day lies within these **first settlements of the Hisar region, predominantly within the Reyhan and Muradiye neighbourhoods**, with typical examples of traditional Ottoman housing and city development⁵.

In the early 20th century, Bursa witnessed the onset of industrial development. Sixteen factories were established **following the First Five-Year Industrialisation Plan in 1933, marking the beginning of urban growth and transformation**. Rapid population growth was observed in mostly urban **areas within the Nilüfer, Mudanya, Gürsu, Kestel, and İnegöl Districts**, and the existing housing supply eventually began to fall short of the growing demand, leading to the formation of unauthorised settlements. Urban growth since then has occurred

in a largely unplanned manner, with **commercial and institutional areas concentrated around the historic core, while new residential areas have developed near Organised Industrial Zones (OIZs) in the outskirts**. While the western region now boasts new residential areas inhabited by middle and upper-income populations, the central and eastern regions are home to low-income neighbourhoods, including unauthorised settlements. Urban growth has mainly occurred along an east-west axis along the route between Ankara and Izmir, **resulting in an urban built-up area of around 1000 km² stretching over a 50 km distance between the Görükle and Turanköy neighbourhoods** (see Figure A2).

The **linear and segregated nature of urban development has resulted in a high cost of provision of networked urban services and high vehicular traffic along the main east-west roads**, reaching up to 1,900 vehicles per hour during peak times and leading to severe congestion⁶. Although **mobility issues have been alleviated to some extent by the light-rail transit (LRT) system and the**

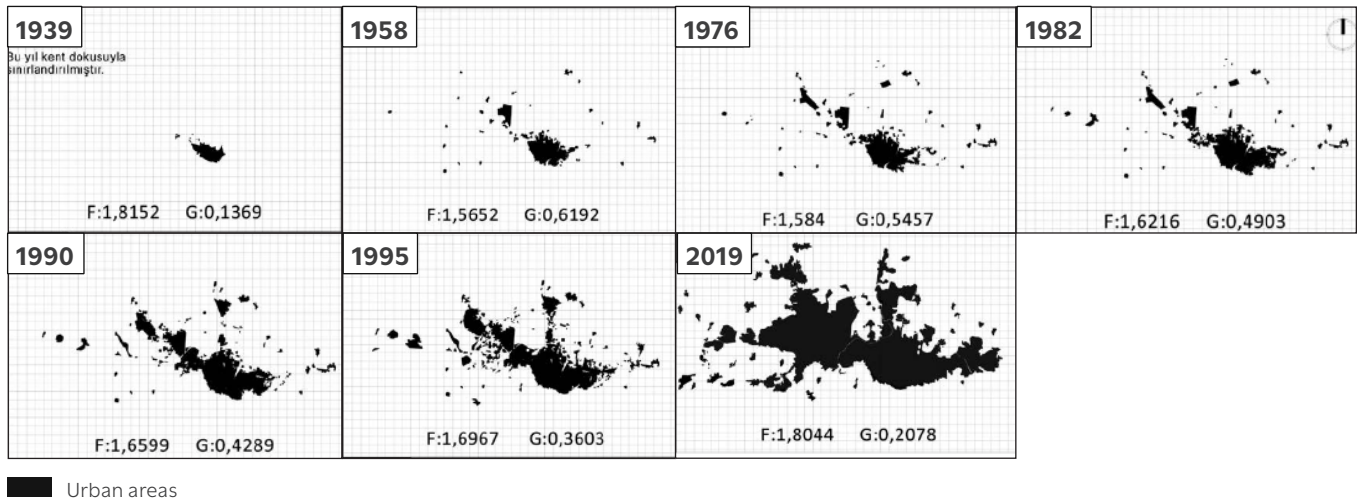


Figure A2: Growth of Bursa City from 1939 to 2019

Source: İlhan, 2019⁷

introduction of the BursaKart integrated payment card for LRT, tram and bus travel, congestion remains a significant challenge. Various stakeholder engagement consultation sessions highlighted **the concentration of urban growth along the east-west axis as a key challenge**, contributing to construction pressure, pollution, and environmental damage, particularly in respect to the loss of agricultural lands.

Despite an average of 12m² of green space per capita across the Province, **the linear pattern of development has resulted in unequal provision and access to green space** across the urban districts, with only 23% of total green space located in these districts. Moreover, provision of green space has not kept up with population growth, with densely populated historic districts (such as Yıldırım) particularly lacking green space provision.

CLIMATE

Bursa experiences **hot, dry summers and cool, wet winters**, with average monthly temperatures ranging from 0 - 8°C in January to 17 - 25°C in August, and an annual average of 11°C. Monthly precipitation varies from 39 mm in August to 109 mm in December, with an annual average of 1,042 mm (see Figure A3). The Province's **proximity to the Marmara Sea and its southern mountainous areas results in significant climatic variation**, Districts like Gemlik and Mudanya, located along the Sea of Marmara have a Mediterranean climate, while southern Districts like Orhaneli and Keles experience harsher and colder conditions⁸.

Climate projections based on a high and low GHG emissions scenarios relative to the baseline years of 1986-2005 show that Bursa is expected to experience increases in average and extreme temperatures, as well as heavy rainfall events, with a more pronounced impact under higher GHG emissions scenarios.

- By 2050 and 2100, the worst-case scenario predicts an annual average temperature rise of around 3.6°C and 7°C, respectively, and a significant increase in days with temperatures above 35°C, reaching 59 days by the century's end; and
- Precipitation levels are projected to decrease, exacerbating drought conditions, while extreme rainfall events may become more intense, with a potential increase of almost 7.0 mm/day in maximum 1-day accumulated precipitation by 2100.

These changes will significantly impact Bursa's critical infrastructure, increasing the frequency and severity of extreme weather events.

The main climate risks and hazards across the Province are:

- **Urban and surface water flooding** - With most of the urban development located in the foothills of the mountain ranges, expansion of unplanned settlements due to increasing population and increasing heavy rainfall due to climate change, resulting in higher runoff, the flood risk and damage to key infrastructure, mainly in urban districts, will worsen.

6. BMM, 1/100,000 scale Bursa Provincial Environmental Plan, Housing and Social Reinforcement Report, (2023), Publicly unavailable at the time of writing.

7. UN Habitat, Bursa City Context Report, (no date), Available at: https://www.globalfuturecities.org/sites/default/files/2020-07/Bursa_CCR_2020rev.pdf, (Accessed: 20/08/2024).

8. İlhan, C. (2019). Kent Dokusu Morfolojik Değişiminin Fraktal Geometri Aracılığıyla Hesaplanması: Bursa Örneği. Kocaeli Üniversitesi Mimarlık ve Yaşam Dergisi, 4(1), pp.116-139. doi:<https://doi.org/10.26835/my.546927>.

9. Uysal, G and Gundogdu, K (2021). A Study On Drought Analysis Using Time Series, Standardized Precipitation Index (Spi) And Standardized Precipitation Evapotranspiration Index (Spei) In Bursa Region. 20220173370 (cabidigitallibrary.org)

- **Extreme heat and drought** - In recent years, Bursa Province experienced meteorological, agricultural and hydrological droughts, which impacted water supply to households and industry^{9 10}. This phenomenon could worsen in the future as dry conditions from lack of rain in the Province are expected to persist and worsen by the end of the century¹¹. As rainfall patterns across Bursa Province vary due to topography, it is expected that rainfall deficits will be more severe in the northern part of the Province.
- **Wildfire** - According to the Regional Directorate of Forest, a total of 547 forest fire events occurred across the Province between 2010 and 2020¹². As projected extreme temperatures and drought become worse, these wildfire events could increase, and cause untoward destruction to the natural environment, infrastructure, and property. 2025 has shown the devastating effects of wildfires across the wider Northwest region of Türkiye, as temperatures reached 33°C and wind speeds exceeded 66km per hour wildfires spread across a large area of the region leading to the evacuation of hundreds and mobilisation of 700 firefighters¹³.
- **Sea level rise** - Bursa Province's coastal zones along the Marmara Sea comprise three districts, namely Gemlik, Mudanya and Karacabey. Under the extremely high GHG emission scenario, the average global sea level rise could exceed 1m by 2100¹⁴, thereby accelerating coastal erosion, saltwater intrusion and risk of flooding due to storm events. Despite the low occurrence of such events, the coastal districts remain highly vulnerable¹⁵ due to increasing population density and immigration, putting excessive pressure on infrastructure.

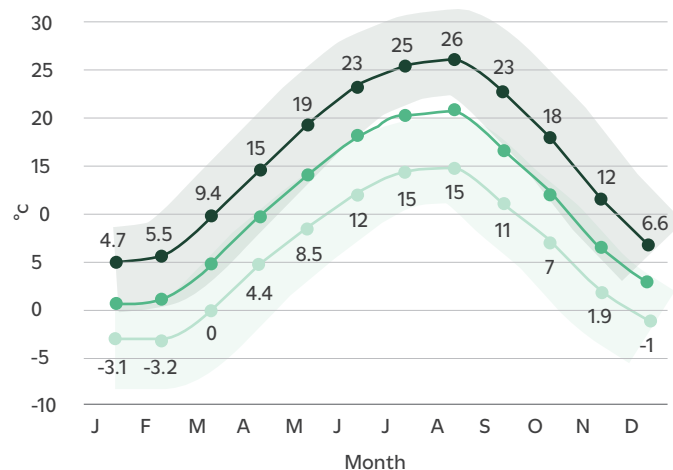
10. Katip, Aslıhan. (2018). Meteorological drought analysis using artificial neural networks for Bursa city, Türkiye. [Meteorological drought analysis using artificial neural networks for Bursa city, Türkiye](#)

11. [Multidimensional assessment of agricultural drought vulnerability based on socioeconomic and biophysical indicators](#)

12. Pekpostalci S, Rifat Tur D, Mehr A, Ghaffari M, Dąbrowska D and Nourani, V (2023). "Drought Monitoring and Forecasting across Türkiye: A Contemporary Review" Sustainability 15, no. 7: 6080. [Drought Monitoring and Forecasting across Türkiye: A Contemporary Review](#)

13. Disaster and Emergency Management Authority (AFAD) (n11) 50-51

Annual average temperature



- Monthly average of daily maximum
- Monthly min/max of daily maximum
- Monthly average of daily average
- Monthly average of daily maximum
- Monthly min/max of daily minimum

Annual average precipitation

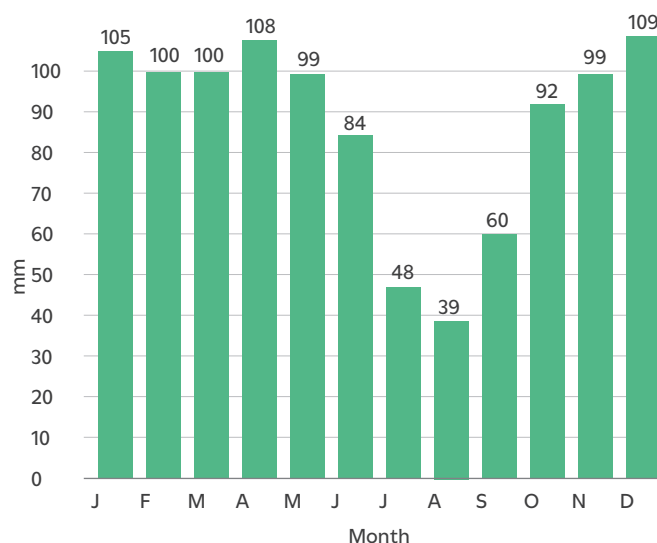


Figure A3: Monthly climatology data based on ERA5 hourly data sets from 1981-2010

Source: Lobelia Earth (2023)

PEOPLE

Bursa is the fourth most populous province in Türkiye, with its population standing at 3.2 million as of 2023¹⁶, with a nearly proportionate gender ratio. **62% of the population (approximately 2 million people) lives within the urban core of Bursa**. The region's industrial development has been instrumental in driving the high population growth rate since the 1980s, mainly because of strong internal migration¹⁷. Population growth in Bursa exceeded the national average between 2007 to 2014 at around 1.4% per year, while internal migration reaching a growth rate of 7.0% in 2015. A population growth rate of 12.2% was projected for 2023, with the population estimated to reach 3.43 million by 2030, as shown in Figure A4.

Since the outbreak of the Syrian civil war in 2011, more than half of Syria's population has been forced to seek shelter in neighbouring countries like Lebanon, Jordan, and Türkiye. Since 2014, Türkiye has been the world's largest host of Syrian refugees, hosting 3.7 million registered Syrians as of 2022¹⁸. **In Bursa, as of August 2024, Syrian refugees represented 5.07% of the Province's population**¹⁹. Refugees are concentrated in the central districts of Yıldırım, where in 2020 10% of the districts population were refugees, and Osmangazi Districts²⁰. When compared to cities like Istanbul and Gaziantep, the total number of refugees does not seem significant in Bursa; however,

the influx of refugees represents a significant proportion of population growth in the city over the last decade. Stakeholder consultation suggest that there are challenges with the integration of refugees in the city, and refugees are perceived as placing additional strain on existing municipal infrastructure.

14. Reuters, Hundreds evacuated in northwestern Türkiye as authorities fight wildfires, (2025), Available at: <https://www.reuters.com/sustainability/climate-energy/hundreds-evacuated-northwestern-turkey-authorities-fight-wildfires-2025-08-11/>
15. Eliawa A, Numanoğlu Genç A, Tora H, Maraş HH. (2023). Risk Assessment of Sea Level Rise for Karasu Coastal Area, Türkiye. Hydrology. [Risk Assessment of Sea Level Rise for Karasu Coastal Area, Türkiye](#)
16. Arda, T., Bayrak, O.C. & Uzar, M. (2024). [Analysing Coastal Vulnerability Using Analytic Hierarchy Process and Best–Worst Method: A Case Study of the Marmara Gulf Region](#)
17. TÜİK, Address based population registration system results, (2023), Available at: <https://data.tuik.gov.tr/Bulten/Index?p=The-Results-of-Address-Based-Population-Registration-System-2023-49684>, (Accessed: 20/08/2024).
18. BEBKA, Bursa Eskişehir Bilecik Regional Plan 2014–2023, (2014), Available at: https://www.bebka.org.tr/admin/datas/yayins/92/bolgeplani2014-2023web-2_1543236013.pdf (2014). (Accessed: 20/08/2024)
19. Imrie-Kuzu, D. and Özerdem, A. (2023) 'Keeping Syrian refugees in Türkiye is not a good idea: a new concept of 'reluctant local integration'', Third World Quarterly, 44(7), pp. 1606–1624. doi: 10.1080/01436597.2023.2197205.
20. Presidency of Migration Management, Distribution of Syrians under temporary protection by year, (2024), available at: <https://en.goc.gov.tr/temporary-protection27>, (Accessed 19/08/2024).
21. <https://mbbkulturyayinlari.com/uploads/old-site/2022/03/marmaranin-kent-multecileri-raporu.pdf>

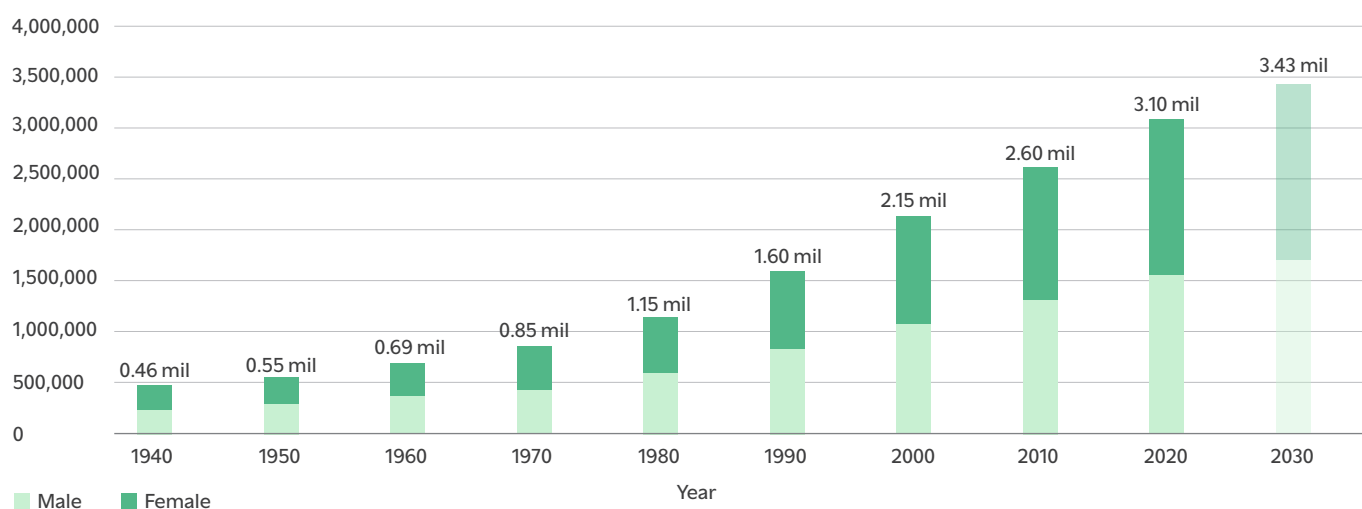


Figure A4: Total population by decade and gender
Source: TURKSTAT

Despite the rapid population growth and increased internal migration, Bursa's population is slowly **demonstrating an ageing population pattern** seen in developed countries like Japan and Korea²¹. The ageing population is reflected in a combination of a decreasing birth rate, an increasing elderly dependency ratio and a general upward trend in Bursa's median age, which was 35.9 in 2023, from 32.6 in 2013²². The population dependency ratio in Bursa is 44.6% and has shown a gradual increasing trend. Bursa has consistently seen a high literacy rate compared to the rest of the country, with a literacy rate of 98.1% in 2022, compared to 94.8% in 2008.

The rapid population growth – driven by strong internal migration historically and by the influx of refugees more recently – has resulted in **greater demand for housing, leading to a sprawling urban form and growth in unplanned settlements** across urban districts and industrialised rural districts. Population growth has imposed pressure on municipal infrastructure, land use, protected landscapes, forests and agricultural land, further **leading to poor air, water and soil quality and increased GHG emissions**.

22. BEBKA, Bursa Eskişehir Bilecik Regional Plan 2014-2023 (2014), Available at: https://www.bebka.org.tr/admin/datas/yayins/92/bolgeplani2014-2023web-2_1543236013.pdf (2014). (Accessed: 20/08/24)

23. TÜİK, International migration statistics, (2022), Available at: <https://data.tuik.gov.tr/Bulten/Index?p=International-Migration-Statistics-2022-49457>, (Accessed: 20/08/2024).

24. Global Future Cities Programme, Bursa City Context Report (2018). Available at: [Bursa_CCR_2020rev.pdf](#) (globalfuturecities.org)

25. Ibid

26. BMM, 1/100,000 scale Bursa Provincial Environmental Plan, Social-demographic structure report, (2023), Publicly unavailable at the time of writing.

27. BMM, 1/100000 Scale Bursa Environmental Layout Plan, Socio-Demographic Structure Report (2021)

28. TURKSTAT, Methodological Document Related Main Revision On Annual Gross Domestic Product News Release, available at: https://www.tuik.gov.tr/indir/metodolojikDokumanlar/yillik_gsyh_metod_en.pdf

ECONOMY

Bursa is **one of the most industrialised Metropolitan Municipalities in Türkiye**, serving as the leading manufacturing centre of textile, automotive, machinery, agriculture and furniture²³. Industry and manufacturing made up **nearly two-thirds of its GDP in 2022** (Figure A5). Moreover, Bursa has the second largest employment base for industrial and manufacturing jobs, accounting for 9.23% of the total jobs in this sector across the country²⁴. The 17 operational Organised Industrial Zones (OIZs)²⁵ act as a major driver of Bursa's economic prosperity and have influenced its urban growth in the 20th and 21st centuries. Industrial activities have shifted over time, with textiles undergoing a decline while the automotive industry, food, agriculture, animal husbandry and machinery manufacturing are undergoing an increase. However, industrialisation has also been **a leading contributor to environmental pollution and GHG emissions**.

In comparison, the contribution of the agricultural sector to the GDP was 3.3% in 2022, showing a slow decreasing trend from its contribution of 3.60% in 2012 and 8.93% in 2004. **During the Covid-19 pandemic, the share of agriculture in Bursa's GDP increased**, suggesting that the sector is especially critical in times of crisis. The cultivated agricultural area in Bursa was 280,536 hectares in 2014, which decreased to 202,920 hectares in 2020²⁶. **The loss of agricultural land in Bursa is at a critical level**, and appropriate interventions are needed to protect agricultural areas and ensure the sustainability of agricultural employment.

Tourism is also considered a significant sector within Bursa, mainly driven by the location of a UNESCO World Heritage Site in the city centre. Bursa is also considered **one of the pioneers in health tourism** with its thermal complexes, and is the **centre of winter tourism in Türkiye** owing to the location of Mount Uludağ. With agriculture and tourism being important economic sectors, **balancing growth in agriculture and tourism with the preservation of natural and protected landscapes** is a key challenge.

In the 2010s, Bursa's **GDP per capita remained relatively stable before a dip in 2020**, presumably as a result of the COVID-19 pandemic and its subsequent economic impact. However, **since 2020, GDP per capita has recovered and increased beyond pre-pandemic figures**. Moreover, Bursa has a **higher GDP per capita compared to Türkiye's national average**; however, it still lags behind the two major centres of Istanbul and Ankara, see Figure A6.

Over the past couple of decades, the **socio-economic and employment indicators in Bursa remained healthy**, with the unemployment rate being 6.6% in 2013, which was lower than the national average of 9%. However, this increased to 9.1% in 2024 with a higher rate of females (11.7%) than males (7.7%).

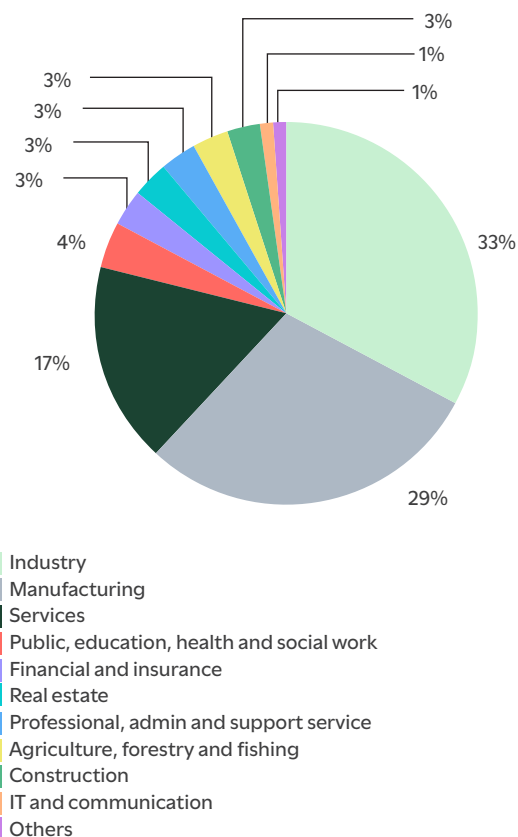


Figure A5: Bursa's GDP by type of economic activity, 2022
Source: TURKSTAT

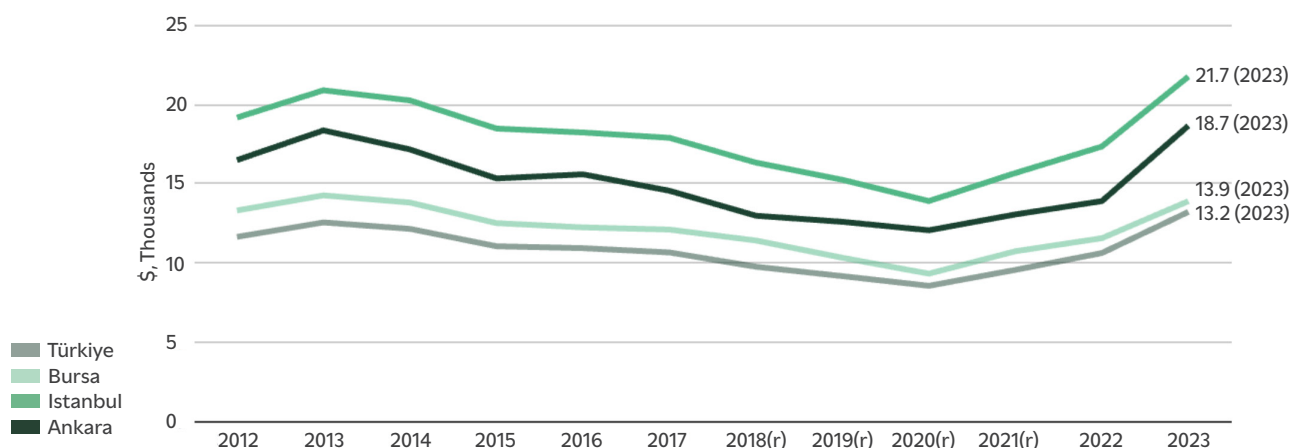


Figure A6: Bursa's annual GDP per capita (\$, thousands)

Source: TURKSTAT ((r) indicates years where figures were revised in accordance with a change in TURKSTAT's National Accounts System²⁷⁾)

CULTURE AND HERITAGE

Bursa is one of the oldest and most important historical cities in Türkiye, with the first human settlement in the region dating back to 5000 BC and the first city established in 200 BC²⁹. Moreover, Bursa was the **first capital of the Ottoman Empire**, up in the 14th century AD. Bursa hosts several historic structures. The districts of **Yıldırım and Osmangazi are home to 6 UNESCO heritage sites** (Figure A7), while **Iznik, Keles, Yenişehir, Mudanya, and Karacabey host a wealth of archaeological protected areas and archaeological sites**. While restoration efforts have become more common, they often focus on individual structures without considering the broader context. As a result, new developments in the vicinity of these historic districts can detract from the overall historical character of the areas. This fragmented approach to conservation threatens the preservation of Bursa's cultural heritage, particularly in districts like Osmangazi and Yıldırım.

The **region has become a tourism hub**, attracting religious, cultural, recreational and health tourists, which has **also significantly influenced the development priorities of the city**. The overall number of tourists in the city has **increased from 1.3 million in 2021 to nearly 2 million in 2022**, primarily after the declaration of Bursa as the 'Cultural Capital of Turkish World in 2022 by the International Organisation of Turkish Culture (TÜRKSOY)³⁰. Bursa is also the centre of winter tourism in Türkiye, thanks to Mount Uludağ, which hosts over 60,000 tourists as of 2021³¹. The Province has seen a shift in its tourism demographics over the years. **Despite the number of tourists doubling since 1990, the proportion of foreign tourists has decreased from 43.4% to 26% in 2017**, with the city attracting more local tourists from within Türkiye rather than foreign visitors. However, the city faces several challenges related to the promotion of sustainable tourism, the protection of heritage buildings and the conservation of natural areas.

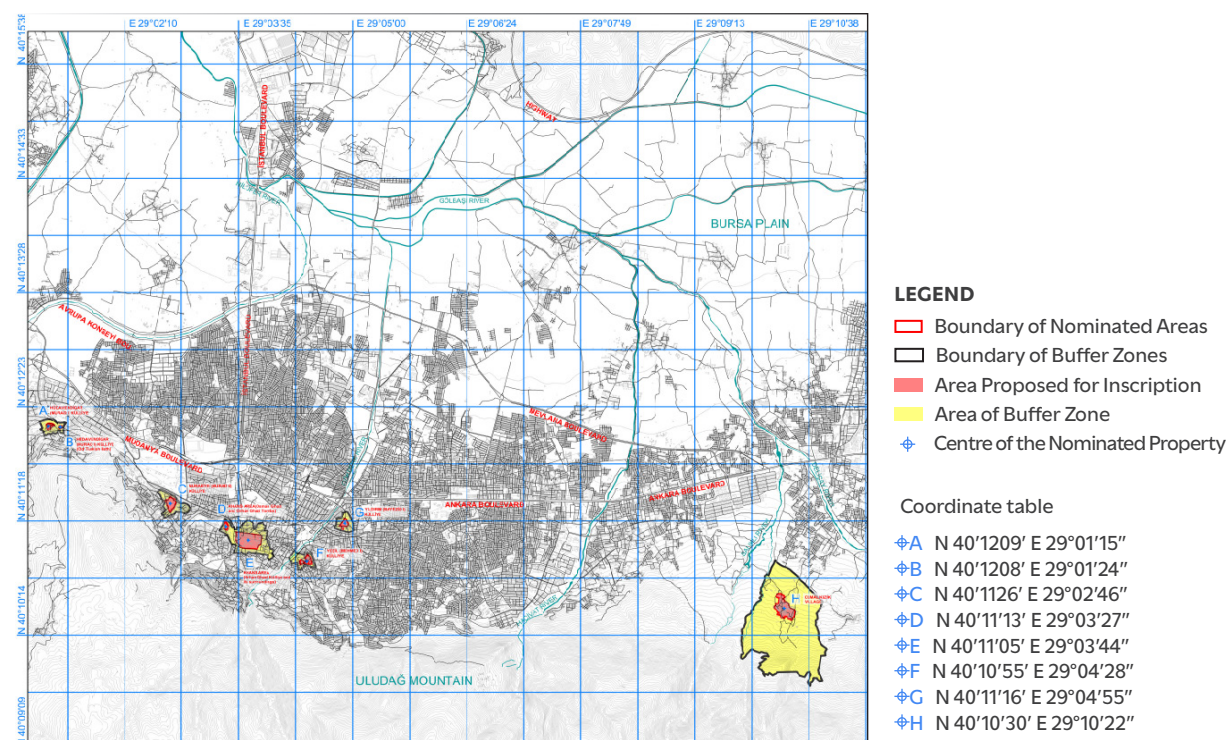


Figure A7: Map of designated UNESCO World Heritage Sites across BMM

Source: UNESCO, 2014²⁸

Governance

INSTITUTIONAL STRUCTURE

Like other Metropolitan Municipalities in Türkiye, Bursa **operates under a two-tier governance system**. The upper-tier is the Bursa Metropolitan Municipality, led by directly elected Metropolitan Mayor and an indirectly elected Metropolitan Municipal Council, which includes representatives from its district assemblies and District Mayors. As the upper-tier, BMM is responsible for macro-level planning and service delivery across the metropolitan area, such as transportation, water and wastewater management, and environmental management. In contrast, District Municipalities focus on micro-level services and local administrative functions within their respective jurisdictions. Functions for District and Metropolitan Municipalities are summarised as follows:

District Municipality Functions

- Street upkeep and hygiene
- Collection of domestic waste
- Preparation of implementation plans (1/1,000 scaled)
- Issue of building licenses
- Social municipal services (reducing poverty, social aid, skills training for the unemployed)
- Promotion of amateur sports
- Education, sports, and culture services

Metropolitan Municipality Functions

- Prepare top-scale (1/5,000 to 1/25,000 scaled) land development plans
- Approve implementation plans (1/1,000 scaled) prepared by the District Municipalities
- Oversee compliance with planning guidelines on land development by district municipalities
- Produce land plots and housing for orderly urbanisation, building infrastructure as required for industry and trade
- Draw up a metropolitan transport master plan; and plan, implement and manage public transport services
- Build squares, boulevards, avenues, and main roads
- Protect and develop the environment, agricultural land and water basins
- Establish and operate transfer stations and disposal facilities for solid waste
- Deliver water and sewerage services
- Build and manage parking areas
- Manage environmental health, including regulation and monitoring of food and drink vendors
- Build regional parks, zoos, museums, sporting, leisure and recreational facilities
- Develop and manage cemeteries, wholesale food markets and slaughterhouses
- Provide firefighting and emergency services

29. BMM, UNESCO (2014), Bursa and Cumalıkızık: the Birth of the Ottoman Empire, Annex 1.e(i), Available at: <https://whc.unesco.org/en/list/1452/documents/>, (Accessed: 07/07/2024).

30. BMM Department of International Affairs, Brief History of Bursa, (n.d.), available at: <https://www.bursa.com.tr/en/sayfa/bursa-nin-kisa-tarihi-46/>

31. URKSOY, Bursa – Cultural Capital of the Turkic World 2022, available at: <https://www.turksoy.org/en-US/news/2022-02-13-bursa-cultural-capital-of-the-turkic-world-2022>

32. BMM, 1/100,000 scale Bursa Provincial Environmental Plan, Tourism and culture report, (2023), Publicly unavailable at the time of writing.

As a Metropolitan Municipality, **BMM benefits from enhanced governance capabilities, clearly defined responsibilities divided between district and metropolitan (province-level) administrations, and greater revenue authority.** Table A1 summarises the powers and responsibilities of BMM (including district government and BMM-owned entities/utilities) across the GCAP sectors, indicating **BMM's ability to implement or influence policy and infrastructure interventions in these sectors.**

In summary:

- BMM has **strong powers to set strategies and goals, implement policies and infrastructure interventions, and influence their operations in the Land Use and Transport sectors.**
- For the **Water and Solid Waste sectors**, BMM's ability to **set standards and goals is weak, as these are powers held by the national government.** However, within the context of national standards, BMM and associated entities (like BUSKI) have a **relatively good ability to set policies and budgets and can implement and operate new assets;**
- Except for Municipal buildings, BMM has **limited ability to directly intervene in the Buildings sector.**

- For commercial and residential buildings, **BMM can utilise its policy-setting powers to establish monitoring or enforcement regimes or implement penalties and incentive-based programmes to influence investment and operations;**
- BMM has **limited power in the industrial sectors**, mainly as national government entities hold policy powers in the majority of industrial areas' assets (e.g., for OIZs). However, **BMM can look to establish monitoring or enforcement regimes or implement incentive-based programmes to influence investment and operations in partnership with large industrial companies** in these sectors; and
- BMM has **strong powers to set and enforce policies and implement policy and infrastructure interventions for small-scale energy infrastructure. Its overall ability to influence grid-level or networked energy infrastructure is limited or weak**, and it will need to involve distribution companies in any actions requiring intervention in this area.

This analysis has informed the **identification of suitable governance and implementation approaches for actions to help improve their feasibility of implementation within the 5-year GCAP implementation timeframe.**

Sector	Vision Setting	Set & Enforce Policies	Budget & Revenue	Own & Operate
LAND USE				
BUILDINGS				
INDUSTRIES				
TRANSPORT				
WATER				
ENERGY				
SOLID WASTE				

LEGEND

● Weak / no powers ● Limited powers ● Strong powers

Table A1: Summary of Sectoral Powers and Responsibilities

Source: Based on technical expertise, relevant laws and stakeholder engagement during the GCAP development process.

MUNICIPAL FINANCE AND INVESTMENT PLANNING

From 2019 to 2023, **BMM has seen a 538.3% increase in its revenue budget**. This is **partly linked to the expanded role and responsibilities of metropolitan municipalities in the Turkish multi-level governance system** – but the proportion of the increase is largely attributable to the **inflationary environment in the country**. As shown in Figure A8, **if TRY values are considered, central government transfers to BMM have increased by 525.9% between 2019 and 2023; however, the EUR value of central government transfers (using the average annual TRY:EUR exchange rate) shows a 39% increase**.

The bulk of revenues is derived from non-tax revenues, which include, e.g. rental incomes from municipally owned facilities, land sales, and license fees for buses and taxis. In 2023, non-tax revenue made up the majority of BMM revenue of TRY 13.6 billion, equivalent to around EUR 478 million. In this period, **BMM's budget balance has closed with an average annual surplus of 14.8%**.

Most of BMM's capital expenditures are associated with transportation (mainly asphalt pavement and road construction) and parks and garden projects (including their maintenance and operation). In 2023, transport and parks and gardens projects made up the majority of BMM expenditures at TRY 13.3 billion, equivalent to around EUR 467 million. **Capital expenditures for investment have averaged around TRY 2 billion** (approx. EUR 110 million) per year between 2019 and 2023.

BMM produces five-year strategic planning reports, annual financial year performance program reports, annual financial status and expectation reports, and annual activity reports in terms of investment planning. BMM prepares these reports in line with mandatory accounting standards set by the central government.

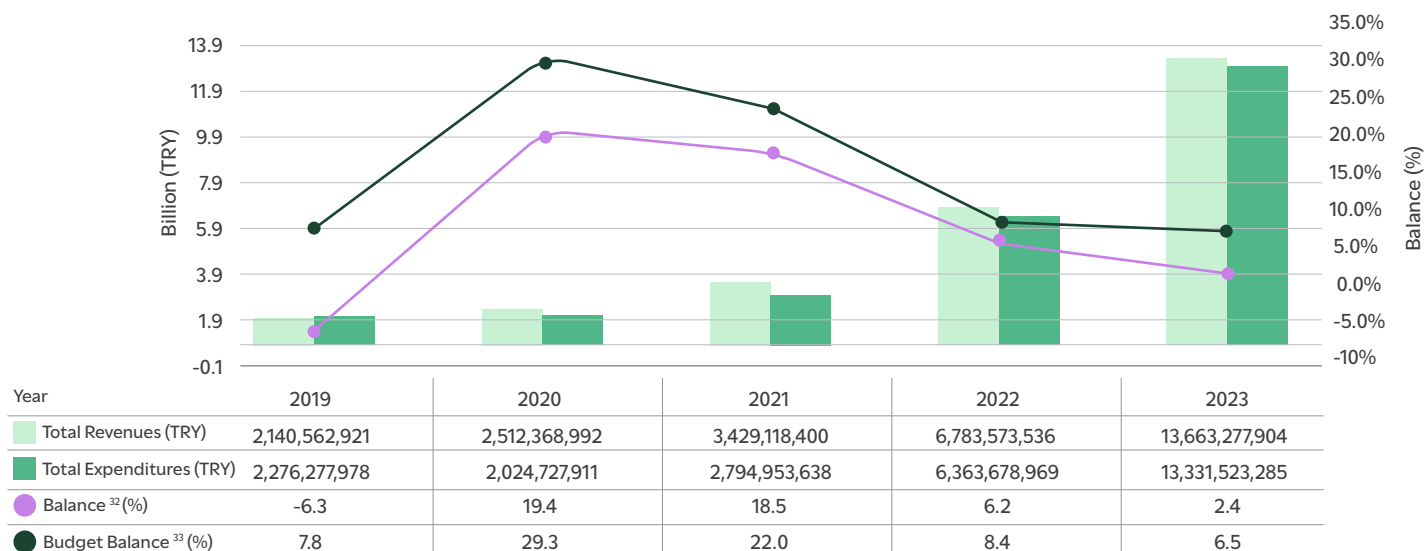
BMM has experience with different forms of financing for infrastructure investments. **The primary source for infrastructure financing is Ilbank**, who issue loans to BMM with guarantees from the national Ministry of Finance. For several

investments, **BMM and its affiliated institutions have secured financing from International Financial Institutions (IFIs) like EBRD, European Investment Bank (EIB), World Bank, Agence Française de Développement (AFD), Japan International Cooperation Agency (JICA), and Kreditanstalt für Wiederaufbau (KfW) and received grants from national government agencies or ministries**. BMM can act as guarantor for loans raised by Ilbank to its affiliated institutions and subsidiaries. **Borrowing over the 2019-2023 period has averaged around TRY 276 million per year (approx. EUR 23 million)**.

BMM demonstrates good capacity and knowledge around financial management and infrastructure development, particularly demonstrated by its ability to secure and manage funds for large-scale infrastructure projects with the EBRD and EIB. The unified financial approach across BMM's affiliates and subsidiaries, such as BUSKI and BURKENT, further showcases the municipality's integrated capacity to align its financial strategies with broader urban development goals. Additionally, the municipality's ongoing efforts to enhance its green infrastructure through incentives and grants reflect a forward-looking capacity to integrate sustainable practices within its urban planning framework.

From the perspective of municipal finance and investment planning, BMM stakeholders noted that their main challenges involved a lack of knowledge, suitable opportunities and experience in undertaking Public-Private Partnerships (PPP), and high inflation over the recent years which has put significant pressure on BMMs' expected income and expenditure.

BMM Municipal Budget 2019-2023 in Turkish Lira (TRY)



BMM Municipal Budget 2019-2023 in Euros (EUR)

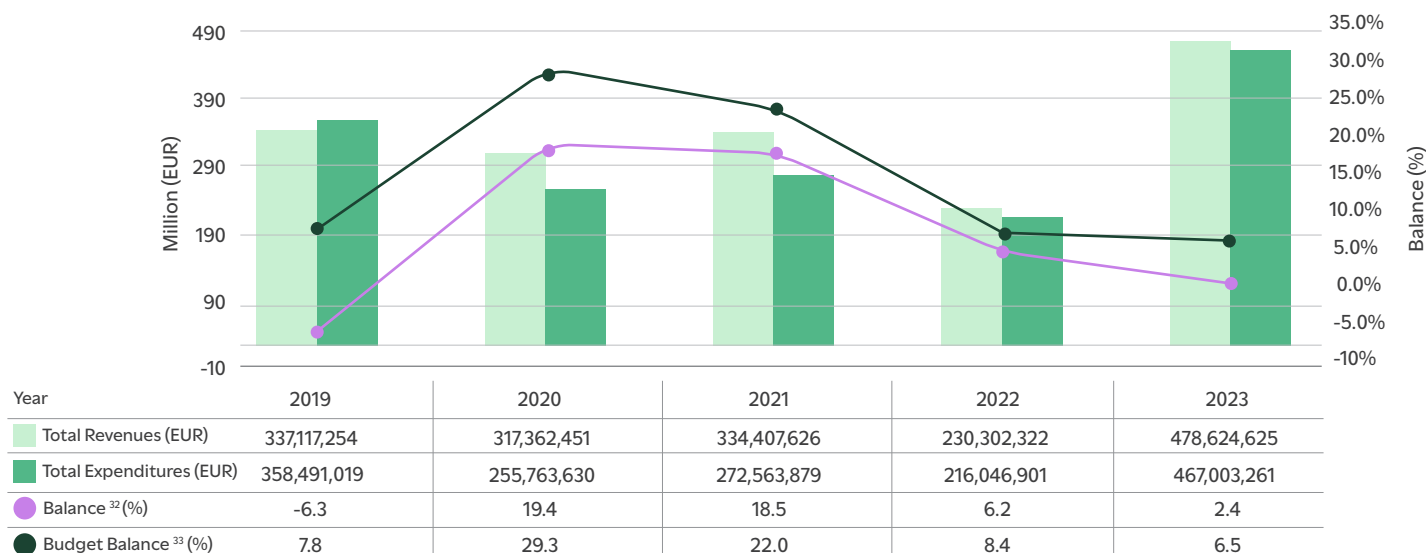


Figure A8: BMM Municipal Budget 2019-2023, in Turkish Liras and Euros ³⁴

Data sources: BMM. Institutional Financial Status and Expectations Report. 2019, 2020, 2021, 2022, 2023. Bursa.

33. Revenues minus Expenditures

34. Balance plus Borrowing

35. Average annual exchange rate for TRY:EUR: 2019 - 0.15749; 2020 - 0.12632; 2021 - 0.09752; 2022 - 0.03395; 2023 - 0.03503

SMART MATURITY

Table A2 summarises the **outcomes of the Smart Maturity Assessment for various sectors in BMM**, capturing the **extent of digital transformation initiatives and mainstreaming of data-driven and digital technologies** across a five-point maturity scale, ranging from 'Initiating' (lowest maturity) to 'Pioneering' (highest maturity).

In summary:

- The **Land Use, Transport, and Water sectors show relatively high smart maturity**. Smart technologies for data collection and monitoring, and to support analysis and decision-making, are well-established in these sectors. **Better integration of data and improved coordination between various digital tools and transformation initiatives** will help maximise benefits and outcomes from the use of 'smart' solutions in these sectors.
- The **Industries, Energy, and Solid Waste sectors show low smart maturity**. While there are initiatives for digital transformation and smart solutions in the pipeline (especially for the Solid Waste sector), their implementation and mainstreaming into operations have not taken place. Actions in these sectors could consider **leveraging smart solutions to automate the monitoring of environmental data, tracking resource use, and setting up data-driven processes for decision-making**.

- The Buildings sector has the greatest potential for implementing smart maturity initiatives. **A fundamental challenge for the Buildings sector is the unavailability of data on energy efficiency, building quality and safety** – an area where digital solutions like smart meters and building information dashboards could prove to be effective and feasible solutions to the challenge.

Sector	Initiating	Enabling	Integrating	Optimising	Pioneering
LAND USE					
BUILDINGS					
INDUSTRIES					
TRANSPORT					
WATER					
ENERGY					
SOLID WASTE					

Table A2: Summary of Sectoral Smart Maturity Assessment
Source: Based on technical expertise and stakeholder engagement during the GCAP development process.

GENDER AND ECONOMIC INCLUSION

Gender and Economic Inclusion (G&EI) is an important element of Turkish national and local policy. Türkiye **ratified the UN Convention on the Rights of Persons with Disabilities in 2009 and recognises the importance of gender representation within climate policy** as part of the UN Framework Convention on Climate Change. Moreover, Türkiye has developed **several national policy frameworks that address G&EI, which provide guidance to regional and local governments**, including the Fourth National Action Plan on Combating Violence Against Women (2021–2025) and the 2030 Barrier-Free Vision Document aimed at removing barriers for people with disabilities.

At the local level, **BMM launched its Local Equality Action Plan 2024–2026**, setting out its goals to raise awareness and visibility of G&EI issues, drive economic empowerment and social support, develop safe and accessible infrastructure, combat gender-based violence and harassment, address climate and gender inequalities and foster a healthy and inclusive city. Despite these efforts, and similarly to the national level, the city continues to have limited female representation in elected government positions with multiple cultural and structural barriers remaining in place³⁵. Early assessment identified that main underserved and vulnerable groups in the city included the **elderly, youth, women, PWD, refugees, persons with low literacy levels, low-income families including single mothers/female-headed households, persons with no digital literacy or access to digital tools**. Unless appropriate remedial actions are taken, these groups can be adversely affected by negative project externalities or enjoy more limited benefits in terms of project impact.

A **Gender and Economic Inclusion (G&EI) Assessment** was undertaken as part of the GCAP development process to understand the **current G&EI conditions and potential outcomes of the GCAP to promote inclusion and positive social and gender impact**. This assessment included reviewing relevant available reports, legislation, and public documents. Where possible, it included gender-disaggregated data available in documents such as national and municipal census, international and national poverty and household databases, and municipal transportation data. The Assessment also incorporates **findings and perspectives from stakeholder consultation**. The outcomes of this G&EI Assessment for the various sectors in BMM are summarised below and in Table A3; it captures, where possible, **the level of access to urban infrastructure, access to safety, and affordability of services, women’s access to skills and employment across the eight sectors**.

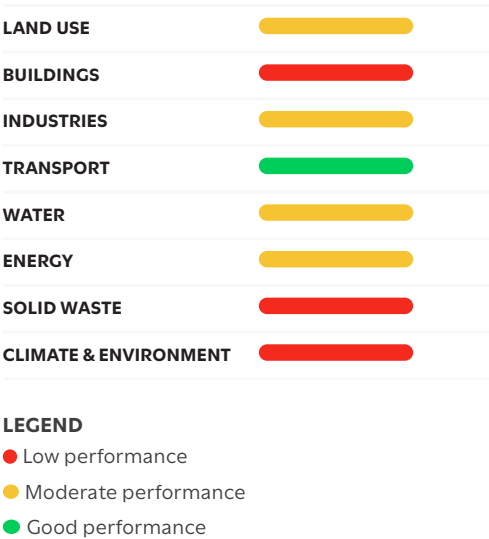


Table A3: Summary of G&EI performance for urban infrastructure sectors in Bursa
Source: AtkinsRéalis analysis

36. IEMed., The Participation of Woman in Economic, Professional and Social Life in Türkiye, (2025), Available at: <https://www.iemed.org/publication/the-participation-of-women-in-economic-professional-and-social-life-in-turkey/#:~:text=Turkey%20needs%20to%20make%20solid,representation%20and%20participation%20in%20politics.>

In summary:

- The **Industries sector shows relatively good performance in mainstreaming G&EI**. Several gender-focused initiatives are underway in this sector, especially around increasing women's participation in the industrial workforce and career development.
- The **Land Use, Transport, Water, and Energy sectors show moderate performance in mainstreaming G&EI**, through the policies and plans adopted, e.g., offering discounted fares for transport, water and energy services to vulnerable groups, and policies to ensure accessible infrastructure design. However, there are some gaps and inconsistencies with implementation – for example, some parks and open spaces do not incorporate inclusive design elements or electrical boxes are installed in the middle of pavements. Moreover, there is a lack of data and information when assessing the intersectionality between these sectors and the associated impacts of climate change relating to G&EI.
- The **Buildings, Climate and Environment, and Solid Waste sectors generally show low performance in mainstreaming G&EI**. In the Buildings sector, there is a lack of disaggregated demographic data and information associated with where vulnerable groups live and what condition of the buildings they live in, making it difficult to understand, for example, the extent of energy poverty or the possible application of energy efficiency devices. The lack of data is also an issue for the climate and environment sector, making it difficult to understand the impacts of environmental pollution and climate change on the various vulnerable groups. For the solid waste sector, the main issue is associated with informal waste pickers and the lack of information and visibility of their health and working conditions, particularly for women.

Baseline Assessment

The indirect environmental impacts of Bursa's geography, climate, and urban development patterns have been **mitigated or exacerbated by policy and infrastructure interventions** in its land use, buildings, industries, transport, water, energy, solid waste, and climate & environment sectors. By **analysing the impact of these factors on environmental performance**, Bursa can develop suitable and targeted measures to foster sustainable urban development, build climate resilience and address environmental challenges.

Climate and Environment

This chapter **summarises the analysis and key findings from the Baseline Assessment of topics related to Bursa's Climate and Environment, and Municipal and Urban Infrastructure sectors**, carried out between June and August 2024.

Guided by EBRD's GCAP Methodology and data collected using the EBRD Indicator Database, the Assessment involved a technical assessment of quantitative and qualitative data carried out by international and local sectoral experts. Key findings and conclusions were validated with stakeholders in the city, including through Sectoral Meetings with expert stakeholders and an online survey that obtained responses from more than 1100 residents across the city.

OVERVIEW

The Technical Baseline Assessment evaluated the performance of the following Climate and Environment topics: air quality, water resource and quality, land and soil quality, biodiversity and open space, climate change mitigation, climate change adaptation and disaster resilience. Key findings from this detailed assessment have been summarised in this section, with the following key used to indicate various dimensions of performance.

Key:

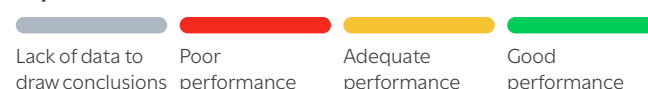


Table A4 highlights the priority environmental topics for Bursa, following the findings from the baseline assessment. For each topic, further details related to its baseline conditions are discussed in further detail in subsequent parts of this chapter.

Environmental topic	Indicator benchmark ³⁶	Evaluated benchmark ³⁷	Stakeholder perception ³⁸	Overall	Priority
AIR QUALITY					High
WATER RESOURCES AND QUALITY					High
LAND AND SOIL QUALITY					Medium
CLIMATE CHANGE MITIGATION					Medium
CLIMATE CHANGE ADAPTATION AND DISASTER RESILIENCE					Medium
BIODIVERSITY AND OPEN SPACE					Low ³⁹

Table A4: Performance on environmental topics

Source: Based on technical expertise, relevant laws and stakeholder engagement during the GCAP development process.

37. Represents the average performance of indicators collected for the environmental topics as part of the Indicator Database.

38. Represents the conclusions and expert judgment of the international and local experts based on qualitative evidence and research conducted for the Technical Baseline Assessment report.

39. Represents stakeholder perceptions of environmental performance, based on inputs gathered during the first and second stakeholder engagement workshops held in May and September 2024 respectively and an online survey undertaken in July and August 2024.

40. When compared to challenges in the air quality, water resource and quality topics, this topic poses lower urgency for the city.

41. <https://www.bursa.bel.tr/hava-kalitesi>

AIR QUALITY

Primary contributors to air pollution

The **main contributors to air pollution in Bursa are industrial activities, traffic and domestic heating, with domestic heating being the biggest source** of air pollution. Between 94-96% of residents rely on natural gas as the main fuel for heating, while the remaining 4-6% of residents rely on wood and coal for heating. Moreover, insufficient thermal insulation in buildings increases the demand for heating. Currently, there are **six air quality monitoring stations operated by the Ministry of Environment, Urbanization and Climate Change** across the Province, including near Bursa (near Sukay Park), Kültürpark, Kestel, Beyazıt Caddesi, Uludağ University and İnegöl - an average of data on air quality indicators from these stations is shown in Table A5.

In addition, more than **30 mobile air quality monitoring devices are operated by BBB and district municipalities**. According to BBM's **2025–2029 Strategic Plan, the number of mobile air quality monitoring devices is targeted to reach at least 40**. These devices are capable of real-time monitoring of relative humidity, temperature, PM2.5, PM10, NO₂, SO₂, and O₃ levels. Additionally, noise levels can be monitored through integrated microphones. The collected data is made publicly available in real time via BBM's official website⁴⁰.

Pollution due to industrial activities

Pollutants from chimneys of textile, cement and furniture production facilities have a negative impact on air quality. The Local Environmental Decree mandates filters for certain types of textile facilities, with standards generally considered stricter than national regulations; however, **issues with air pollution are still present in a handful of industries**. Uncontrolled burning activities, especially from burning of furniture waste in İnegöl, also add to the pollution. **Air pollution from industrial activities was a key issue highlighted during stakeholder consultation**, particularly by those who reside close to OIZs and industrial facilities across the Province.

Impact of geographic and topographic factors

As highlighted in previous sections, the **dominant wind direction in Bursa and the location of most industries in the north** of the Province results in **pollutants being carried by the wind towards the urban core located further south**. Additionally, transboundary pollution from Istanbul and Kocaeli in the north of the Marmara Region are also carried over Bursa, trapping them rather than dispersing them due to the hilly terrain in the south. This **situation worsens during the winter season as fossil fuels are burnt for heating, and colder, dense air traps pollutants near ground level**.

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
1	AVERAGE ANNUAL CONCENTRATION OF PM2.5	24.38 µg/m ³	2023	
1.1	AVERAGE ANNUAL CONCENTRATION OF PM10	51.93 µg/m ³	2023	
1.2	AVERAGE DAILY CONCENTRATION OF SO ₂	7.15 µg/m ³	2023	
1.3	AVERAGE DAILY CONCENTRATION OF NO _x	18.59 µg/m ³	2023	

Table A5: Performance on Air Quality indicators

Data Sources: Provincial Directorate of Environment, Urbanization, and Climate Change

WATER RESOURCES AND QUALITY

Wealth of water resources

Bursa Province is **rich in water resources, including surface water, groundwater and springs**. The province sits across three river Basins with the Nilüfer stream being the main watercourse running through the Province. Bursa is also **home to two major lakes, these being Uluabat and İznik**. **The total water potential in Bursa, according to State Hydraulic Works (DSİ) data, is about 2500 m³ per person per year, which is above the national average of 1600 m³ per person per year**. Around half of all water supplied to the potable water network is supplied by **surface water resources such as dams and reservoirs**, one quarter is from springs, and the remaining quarter is from groundwater wells.

Issues with data and collaboration on water quality

There are case-specific academic studies for water quality data, but there is a **lack of holistic monitoring and a common database regarding water quality**, as exemplified by the inconsistent availability of water quality data in Table A6. This resulted in difficulties in evaluating current water quality across the Province and, therefore, planning investment and environmental rehabilitation. Moreover, this results in challenges in collaboration and data sharing among various institutions and organisations undertaking activities in the water sector.

Lack of knowledge and data on industrial groundwater use

Data suggests industries use around 13% of the Bursa's water, with the majority being supplied from groundwater wells. However, **anecdotal evidence and stakeholder perception suggest that the ratio of water used by industries is far higher** due to a lack of monitoring of groundwater extraction and the possibility of undocumented and illegal extraction activities.

Pollution of surface water resources

Water pollution in Bursa can be categorised into two classes, where **point source pollutants arise from industrial and domestic water uses** (e.g. through discharge of wastewater from treatment plants), and **diffuse source pollutants, mainly from agricultural activities** in the form of agricultural return flow. The **Nilüfer Stream**, which originates from the southern slopes of Uludağ, runs through the urban core and joins with the Susurluk Stream and eventually empties into the Sea of Marmara at the Karacabey Strait, **is exposed to a variety of point and diffuse pollution sources** and has been observed to be one of the most polluted surface water resources in Bursa.

42. BMM, 1/100,000 scale Bursa Provincial Environmental Plan, Environment and Climate Change Analysis Report, (2023), Publicly unavailable at the time of writing.

Vulnerable marine and coastal environment

As a key natural asset and water resource, the **Sea of Marmara and its coastline have pollution events resulting in increased nutrient loads and uncontrolled growth of mucilage**. Around 80% of the marine pollution in the Sea can often be attributed to land-based pollution sources as a result of rapid increases in population, tourist activities, industrial development and associated discharge of partially treated wastewater into the local environment, while 20% is from sea-based activities, such as maritime transport⁴¹. Moreover, climate change is expected to lead to increased coastal erosion, seawater intrusion impacting freshwater sources and agriculture and an increase in coastal flooding due to storm surges. In recognition of these issues, efforts to clean up the sea over the past few years have included the development of the Integrated Coastal Zone Plan for Bursa's Coastline, developed in 2020 and the Marmara Sea Action Plan.

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
WATER BODIES AND DRINKING WATER				
2	BIOCHEMICAL OXYGEN DEMAND (BOD) IN RIVERS AND LAKES	N/A	N/A	N/A
2.1	AMMONIUM NH ₄ CONCENTRATION IN RIVERS AND LAKES	N/A	N/A	N/A
2.2	BATHING WATERS MEETING MINIMUM STANDARDS	71 %	2023	
3	WATER SAMPLES COMPLYING WITH NATIONAL POTABLE WATER QUALITY STANDARDS	100 %	2023	
WATER USE				
5	WATER EXPLOITATION INDEX	42 %	2023	

Table A6: Performance on Water Resource and Quality indicators
Data Sources: BUSKI and Provincial Directorate of Health

LAND AND SOIL QUALITY

Impact of urban and agricultural activities on soil quality

Industrialisation, agricultural activities and residential areas across Bursa impact soil quality across the Province. In particular, intensive agriculture with excessive use of fertilizers and pesticides, discharge of partially treated residential and industrial wastewater into surface water sources, as well as solid waste present in the local environment and landfill sites, contribute to deteriorating soil quality. Although landfill areas within BMM are overall well-managed, **there are some localised issues relating to unrehabilitated, unorganised landfills, which can affect the soil quality in and around the area.** Moreover, competition for land between various land uses has led to the loss and deterioration of productive agricultural land.

Complex interactions between soil, air and water systems

The **soil quality across Bursa can also be impacted by air and water pollution** as a result of the reaction of NO_x (nitrogen oxides) pollutants, resulting in acidic rains. A combination of acidic rains, high use of artificial fertilisers and pesticides in agriculture and polluted water bodies eventually contribute to the deteriorating quality of soils.

Lack of monitoring and data

The **lack of soil quality monitoring and data collection is a major challenge**, as evidenced by the absence of data in Table A7. Although interactions between various land uses and environmental systems can be evaluated, the true impact of these on Bursa's soil and land quality cannot be quantified, which impacts the ability to plan for necessary rehabilitation or specific intervention.

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
4	NUMBER OF CONTAMINATED SITES	N/A	N/A	N/A
4.1	CONCENTRATION OF MERCURY IN SOIL	N/A	N/A	N/A
4.2	CONCENTRATION OF CADMIUM IN SOIL	N/A	N/A	N/A
4.3	CONCENTRATION OF ZINC IN SOIL	N/A	N/A	N/A
4.4	CONCENTRATION OF MINERAL OIL IN SOIL USING INFRARED SPECTROSCOPY	N/A	N/A	N/A

Table A7: Performance on Land and Soil Quality indicators
Data Sources: N/A

BIODIVERSITY AND OPEN SPACE

Rich in biodiversity and natural assets

As a result of its varying climate zones and aquatic environments, the Province is rich in biodiversity, being **home to several endemic endangered species of flora and fauna, and natural assets, including mountains, forests, wetlands, lakes and the Sea of Marmara**. The province is home to several areas designated for their natural value, including the Uludağ National Park, being Türkiye's first National Park established in 1961, Suuçtu Canyon Nature Park and Sadağı Canyon Nature Park, Lake Uluabat Ramsar, Kocaçay Delta Wetland Protected Area.

Unequal access to urban open space

Although the open green space area per 100,000 inhabitants in 2023 was around 12 m²/person, there is a clear regional disparity with the unorganised urban development leading to insufficient open spaces within the urban areas of the Bursa Province, especially with the increasing population. The share of open green space within the urban limits is

inadequate, and access to parks and open spaces is moderate, with **only around 50% of the population having good access to open spaces within walking distance** (Table A8). The denser eastern part of the city has a lower amount of open green space compared to the west. Additionally, the majority of new open green spaces are often planned for the outskirts of the city given the availability of land.

Decreasing natural area within overall land cover

Over the past years, the proportion of natural areas within overall land cover showed a small increase; however, **there was a reduction in natural land cover between 2022 and 2023**. This trend is attributed to increasing industrial and non-compliant development, resulting in pressure on natural areas, which are transformed into residential land uses or for industrial development. This trend also impacts productive agricultural land and has been witnessed over the past few decades as the city has grown towards the east and west.

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
OPEN SPACE				
6	OPEN GREEN SPACE AREA PER 100,000 INHABITANTS	12 m ² capita	2023	
6.1	SHARE OF GREEN SPACE AREAS WITHIN URBAN LIMITS	23 %	2023	
6.2	ACCESSIBILITY TO THE PARK	46 %	2023	
BIODIVERSITY				
7	CHANGE IN NATURAL AREAS	-0.33 %	2023	
7.1	TREE CANOPY COVER	45 %	2023	
7.2	CONNECTIVITY OF NATURAL AREA	N/A	N/A	

Table A8: Performance on Biodiversity and Open Space indicators

Data Sources: BMM Department of Parks and Gardens, Regional Directorate of Forestry and AtkinsRéalis technical analysis

NATURAL CAPITAL VALUE

Natural Capital is defined as the ‘stock of renewable and non-renewable natural resources (i.e. forests, rivers, air, wildlife) that combine to yield a flow of benefits to people’ (Natural Capital Protocol, 2016). Broadly, it is the value that nature provides to human society such as clean water and air, food, and flood protection. A Natural Capital Valuation (NCV) Assessment was undertaken using the EBRD’s NCV Approach as part of the Technical Baseline Assessment to **evaluate the qualitative, quantitative, and, where possible, monetary value of existing natural assets across Bursa.**

Ecosystem services mainly apply to the following ecosystem types across Bursa, forests, water, urban greenspace, and wetlands, with their spatial distribution and abundance shown in Figure A9. Forests are the largest land cover by area, 56% of Bursa Province, followed by 22% used as cropland and for other forms of agriculture. Around 3% of the land area in Bursa Province is built-up. Urban green spaces⁴² accounts for around 3% of the total BMM area which as discussed previously is around 12m² per capita.

In determining the monetary ecosystem services flows in Bursa, the following ecosystem services were valued: water supply, global climate regulation, water quality, recreation, flood regulation, fish provisioning,

and crop provisioning. These were the ecosystem services deemed most important to Bursa.

Where possible, local values from Türkiye were used to be more representative of local conditions. Table A9 and Figure A10 provides an overview of the total annual ecosystem service value of each of the ecosystem types.

Following this assessment of ecosystem value for the main ecosystem types in Bursa, a high-level risk assessment was carried out to identify the main risk areas across the Province and their relative impact and likelihood of manifesting over the coming years. As show in Figure A11, the nature-related heat risk map indicates that nature-related risks linked to water quality, extreme events, and temperature and precipitation were deemed the most severe and likely risks in Bursa, most notably as a result of climate change and urbanisation increasing pressure on resources and leading to deteriorating environmental quality.

43. Urban Green Spaces were identified using Open Street Map data, these including, children’s playgrounds, park areas, sports areas, picnic and entertainment areas, public groves and recreation areas and other open green spaces classified as parks.

44. Copernicus, Land Cover 2019 (raster 100m), Global, Yearly – version 3, (2024), Available at: <https://land.copernicus.eu/en/products/global-dynamic-land-cover/copernicus-global-land-service-land-cover-100m-collection-3-epoch-2019-globe>, (Accessed: 07/07/2024).

LEGEND

■ BMM

□ Districts

□ Open green space in BMM urban districts - 40,763 ha

□ Shrubland - 61,735 ha

□ Herbaceous vegetation - 46,195 ha

□ Cropland - 242,089 ha

□ Built-up - 35,301 ha

□ Bare/sparse vegetation - 544 ha

□ Snow and ice - (seasonal)

□ Open water bodies - 42,033 ha

□ Herbaceous wetlands - 5,605 ha

□ Forest - 616,096 ha

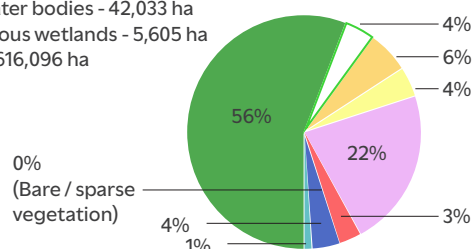
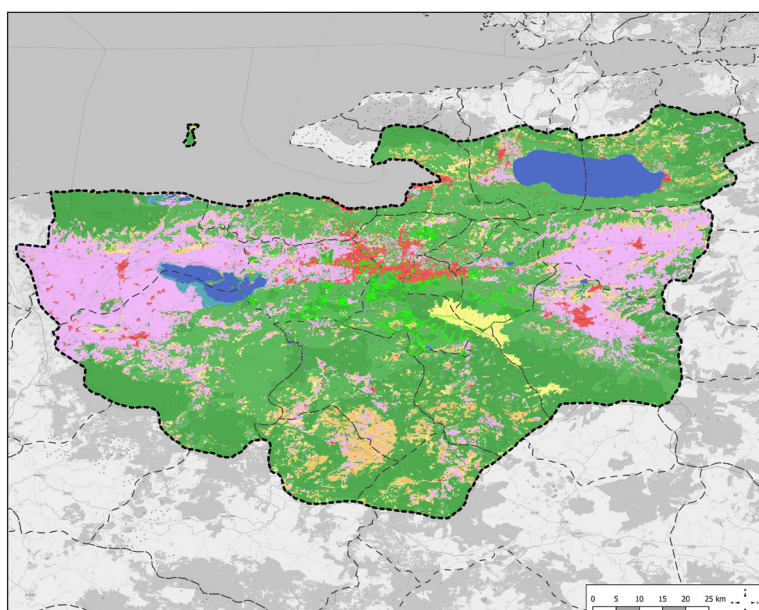


Figure A9: Ecosystem types across Bursa

Source: AtkinsRéalis adapted from Copernicus Global Land Service⁴³



High value associated with wetland and aquatic ecosystems

The **highest ecosystem value comes from the recreational value of wetland ecosystems**. As depicted in Table A9 and the chart on the left in Figure A10, wetlands represent the highest proportion of ecosystem value. Moreover, preserving and enhancing these, as well as other aquatic assets, is key to maintaining a healthy ecosystem. However this result is skewed on account of the large recreational value of wetlands --

the two biggest lakes in Bursa (İznik and Uluabat) are located near large urban population centres and attract a large number of visitors, leading to high recreational values. Given this very high contribution of wetland recreational value to the total ecosystem value, the chart on the right in Figure A10 shows the distribution of ecosystem values in Bursa when the recreational value of wetlands is excluded.

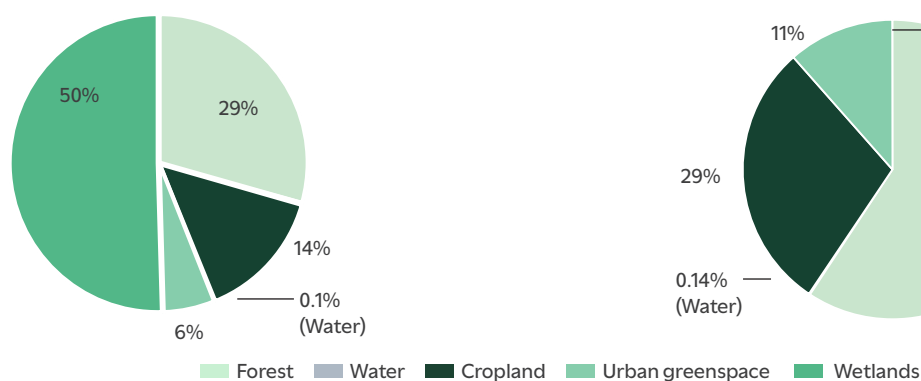
45. A natural capital valuation approach should exclude the costs of production related to food provisioning services. However, in the absence of data, the monetary values for the fish and crop provisioning services are full values that do not exclude costs, and thus may be an overestimate.

	Forest	Water	Cropland	Urban greenspace	Wetlands
Water supply	-	EUR 0.05 TRY 2.17	-	-	-
Global climate regulation	EUR 4,074.38 TRY 183,347.24	-	-	EUR 519.48 TRY 23,376.82	-
Water quality	-	-	-	-	EUR 1.59 TRY 71.40
Recreation	EUR 2,611.29 TRY 117,508.18	-	-	EUR 785.17 TRY 35,332.64	EUR 11,562.11 TRY 520,294.82
Flood regulation	EUR 164.31 TRY 7,393.95	-	-	-	EUR 1.48 TRY 66.65
Fish provisioning ⁴⁴	-	EUR 15.51 TRY 698.13	-	-	-
Crop provisioning ⁴⁴	-	-	EUR 3,302.32 TRY 148,604.18	-	-
Total	EUR 6,735.19 TRY 303,083.67	EUR 15.56 TRY 700.30	EUR 3,302.32 TRY 148,604.18	EUR 1,304.65 TRY 58,709.45	EUR 11,565.17 TRY 520,432.87

Table A9: Total annual ecosystem service value of each ecosystem types in Bursa (in EUR and TRY, millions)

Source: AtkinsRéalis technical analysis

TOTAL ANNUAL ECOSYSTEM VALUE OF BURSA'S ECOSYSTEM TYPES (INCLUDING WETLANDS)



TOTAL ANNUAL ECOSYSTEM VALUE OF BURSA'S ECOSYSTEM TYPES (EXCLUDING RECREATIONAL VALUE OF WETLANDS)

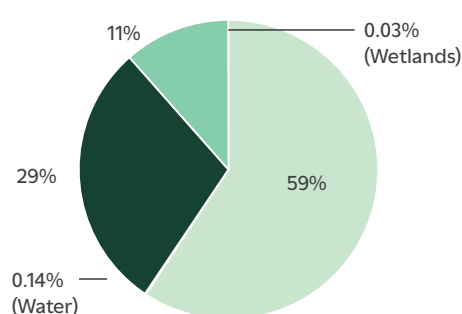


Figure A10: Chart showing the total annual ecosystem value of Bursa's ecosystem types

Source: AtkinsRéalis technical analysis

Importance of urban green space for global climate regulation and recreation

There are also high values associated with urban green spaces for local climate regulation and recreation. Bursa has a high urban greenspace per capita (12 m² of open greenspace per capita). Urban green spaces are valuable for local urban populations for climate regulation benefits, but also benefits associated with physical and mental well-being by providing recreational spaces for physical or social activities. Given the onset of climate change, in particular the increase in potential urban flooding and extreme heat events, urban green space can have a substantial impact in mitigating such hazards; therefore, **enhancing natural capital assets in urban green spaces through the use of nature-based solutions (NbS) should be a priority.**

Abundance of forests and their value to Bursa

There is a large share of forests in the region, comprising over half of the total area of Bursa, which provides benefits for flood regulation. Flood regulation will be a **critical ecosystem service moving forward given an expected increase in the projected total annual precipitation** which will likely lead to increased risk of river and urban flooding. Moreover, forests provide a recreation value in terms of providing visitors with natural spaces for recreation and improving health and wellbeing. **Therefore, forests should be protected, any future loss of forests to urban development or agriculture avoided, and efforts to promote reforestation and the development of urban forests should be promoted.**

Several links exist between the findings of the nature-related heat risk map in Figure A11 and the headlines above. For example, **water provides a high natural capital value to Bursa but is also a key nature-related risk** which could indicate that there is a high likelihood that the value that water ecosystems provide to Bursa could also deteriorate in absence of actions to protect or enhance them. Similarly, Bursa's abundant urban green space could potentially help it better withstand material nature-related risks such as temperature and precipitation changes and extreme events, in which case part of the value of urban green space is linked to its ability to increase resilience to key nature-related risks for the city.

LEGEND - RISK AREAS

- ◆ Water Use & Availability
- ◆ Water Quality
- ◆ Temperature and Precipitation
- ◆ Extreme Events
- ◆ Urban Greenspace Loss
- ◆ Infrastructure Stress
- ◆ Species Diversity

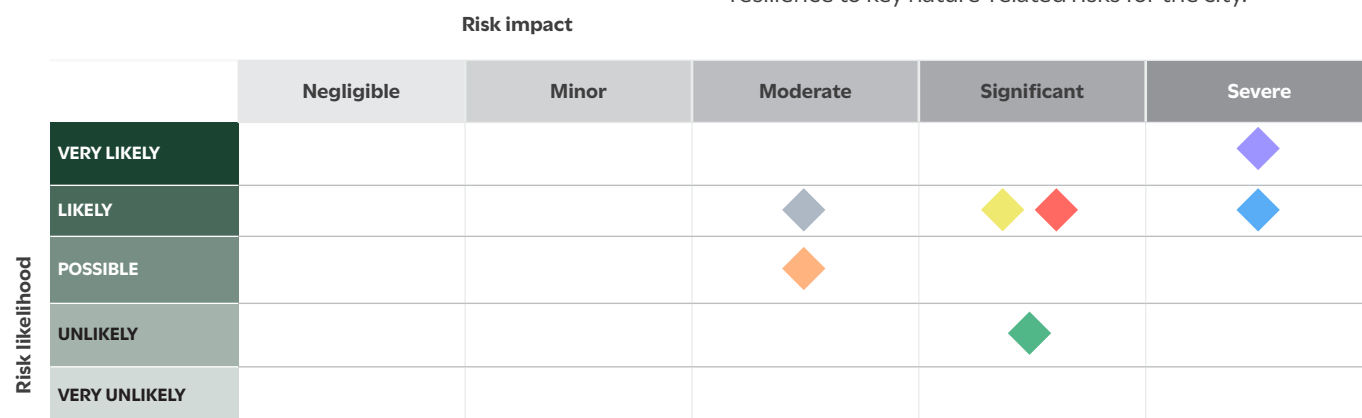


Figure A11: Nature-related risk heat map for Bursa

Source: AtkinsRéalis analysis based on the EBRD's Natural Capital Valuation Approach

CLIMATE CHANGE MITIGATION

Industries, Energy, and Transport sectors contribute the most to total GHG emissions

In 2020, **the largest share of GHG emissions belonged to fuel and electricity consumption in the industries sector**, followed by fuel and electricity used in residential buildings, and urban transport.

Per capita GHG emissions continue to increase

Barring a couple of exceptions, where yearly per capita GHG emissions decreased, **per capita GHG emissions in Bursa have generally increased every year from 4.74 tonnes CO₂e per year (2014) to 5.71 tonnes CO₂e per year (2021)**. However, per capita emissions in Bursa are lower than those for Türkiye, which have varied between 4.0 and 6.7 tons/year/capita between 1990 and 2021. Based on current trajectories, per capita GHG emissions are expected to rise to 11.7 tonnes CO₂e per year by 2050 under a business-as-usual emissions scenario.

No.	Indicator	Unit	Year	Performance per EBRD benchmark
8	ANNUAL CO ₂ EQUIVALENT EMISSIONS PER CAPITA	5.71 tonne/year/capita	2021	
8.1	ANNUAL CO ₂ EMISSIONS PER UNIT OF GDP	0.531 kg/USD of GDP	2021	

Table A10: Performance on Climate Change Mitigation indicators
Data Sources: BMM Department of Environmental Protection and Control

Contrasting patterns in industrial and energy sector emissions

The total emissions for the province were estimated to be 15.85 MtCO₂e. These increased by 20% between 2014 and 2020. **The largest increase in GHG emissions was seen in the Industries sector (42%)**, while the largest decrease was seen in the energy production facilities (-80%).

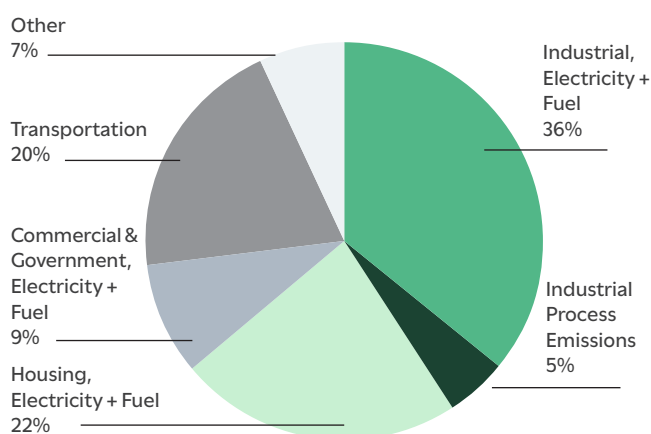


Figure A12: Sectoral shares of GHG emissions, 2020
Source: BMM, BUSECAP Monitoring and Evaluation Report, 2022

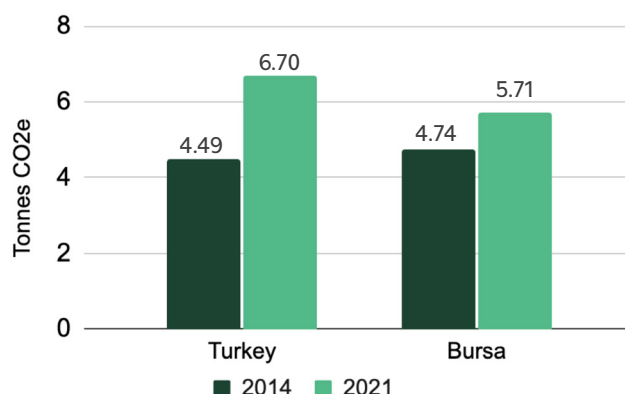


Figure A13: Per capita GHG emissions for Bursa and Türkiye
Source: BMM, BUSECAP Monitoring and Evaluation Report, 2022 and TUIK, Greenhouse Gas Emissions Statistics, 1990-2021

An ambitious GHG emissions reduction target

Türkiye submitted an updated Nationally Determined Contributions (NDC) in April 2023 with the aim of **reducing GHG emissions by 41% below 'business-as-usual' levels by 2030**. In addition, **Türkiye aims to peak its emissions by 2038 at the latest and has targeted net-zero emissions by 2053**, which aims to cover all GHG emissions across all sectors of the economy. On 9 July 2025, Türkiye passed the **first Climate Law** (officially known as Law No.7552) which **establishes a legal basis for national emissions trading system and introduced a framework for climate governance, institutional arrangements and finance mechanisms** aligned with Türkiye's international commitments like the Paris Agreement and the 2053 Net Zero Emissions Target⁴⁵.

Per the 2017 Bursa Climate Action Plan, **Bursa targets a 40% GHG emission reduction by 2030** compared to the 'baseline year' of 2014. Its Sustainable Energy and Climate Action Plan covers mitigation activities in the municipal, tertiary, residential buildings and transport sectors but excludes emissions from industry.

Limited ability within BMM to manage industrial emissions

Globally, city governments have limited ability to drive GHG emissions reductions, with a recent study finding that **local governments have direct power over less than one-third of the emissions reduction potential in their cities**⁴⁶. In Bursa, this challenge is compounded by the share of industries in total GHG emissions.

As stated above, in 2020, the **industrial sector had the highest share of GHG emissions**, with a share of 36% of the total GHG emissions associated with fuel and electricity use in industrial activities. However, **BMM does not have the required powers to mandate reduction in GHG emissions from industries** and therefore rely on action by individual industries to curb their emissions. Coordination and knowledge sharing between BMM and industries will be essential to achieve overall GHG emissions reductions in the sector.

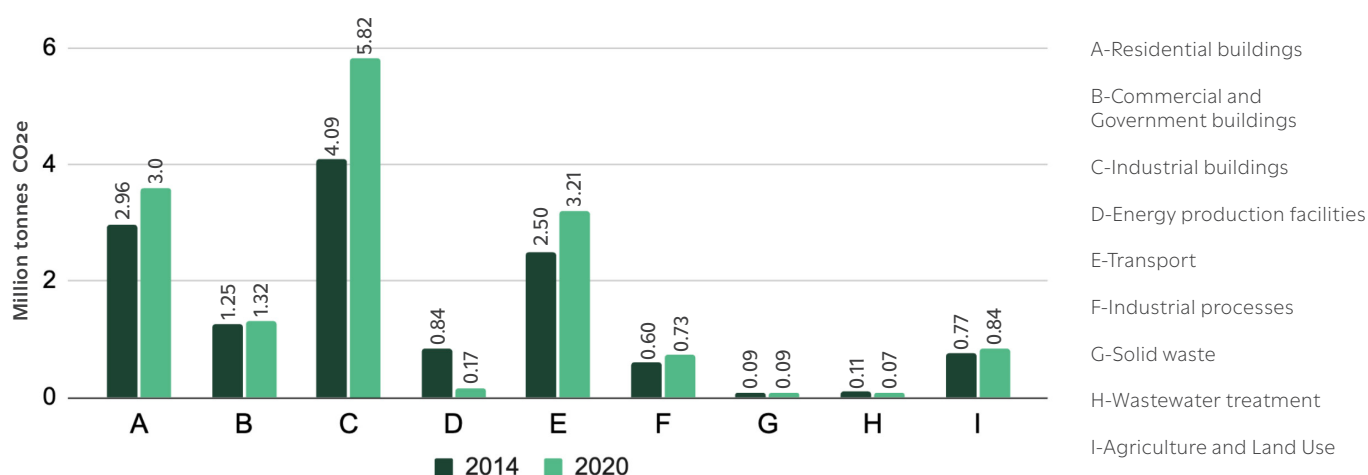


Figure A14: GHG emissions per sector in 2014 and 2020
Source: BMM, BUSECAP Monitoring and Evaluation Report, 2022

Pressure due to Rapid Population Growth

Rapid population growth, primarily due to migration since 2013, has posed significant pressure on BMM's capacity to deliver essential services, complicating target-setting and action planning. **Increasing population has put pressure on electricity and fuel use in buildings and private car use, resulting in increased GHG emissions.** Targeted actions to increase energy efficiency in buildings, shifting towards renewable energy and promoting a shift towards non-motorised and public transport will help to curb such emissions moving forward.

Need for revision in GHG Inventory

Having reliable and up-to-date GHG inventories is critical to understanding the current situation, progress made against targets and developing targeted actions to curb emissions. **The latest comprehensive assessment of GHG emissions and inventories for Bursa was undertaken in 2022**, and the calculation process for 2023 is ongoing. These calculation reports include comprehensive assessments of emissions. Ensuring that the inventory is updated regularly and in a timely manner will strengthen monitoring and evaluation processes and enable the development of more targeted mitigation actions.

46. International Carbon Action Partnership, 2025, Türkiye adopts landmark climate law, paving the way for national ETS, Available at: <https://icapcarbonaction.com/en/news/turkiye-adopts-landmark-climate-law-paving-way-national-ets#:~:text=On%20%20July%202025%2C%20T%C3%BCrkiye%27s,institutional%20arrangements%2C%20-and%20finance%20mechanisms.>

47. Coalition for Urban Transitions. Climate Emergency, Urban Opportunity (2025). Available at: <https://urbantransitions.global/wp-content/uploads/2019/09/Climate-Emergency-Urban-Opportunity-report.pdf>

CLIMATE CHANGE ADAPTATION AND DISASTER RESILIENCE

Exposure to multiple climate and natural risks and hazards

As discussed in previous sections, **annual average temperatures in Bursa are set to increase over the coming decades**, resulting in an increase in extremely hot days. The Bursa Metropolitan Municipality's Climate Change Action Plan⁴⁷ highlights the **projected increase in hot days from 10-15 days in a year between 1961 to 1990 to 30-40 days by 2100**. Precipitation levels are expected to decrease, **resulting in more drought events, while extreme rainfall events are set to become more intense**, resulting in an increase in pluvial flooding events.

Moreover, **Bursa's location along a seismically active zone makes it particularly exposed to geophysical hazards**, such as earthquakes and landslides. These pose a significant risk to BMM, its people, economy and infrastructure. Urban areas and the buildings sector are also highly vulnerable due to high population density, unplanned settlements, and non-compliant buildings not adhering to modern-day building codes. The summary of risk assessment and geographic spread of risks is shown in Table A13.

No.	Indicator	Unit	Year	Value
9	ESTIMATED ECONOMIC DAMAGE FROM NATURAL DISASTERS FLOODS DROUGHTS EARTHQUAKES ETC. AS A SHARE OF GDP	N/A	N/A	N/A
9.1	PERCENTAGE OF PUBLIC INFRASTRUCTURE AT RISK	N/A	N/A	N/A
9.2	PERCENTAGE OF HOUSEHOLDS AT RISK	N/A	N/A	N/A

Table A11: Climate Change Adaptation and Disaster Resilience Indicators

Data Sources: N/A

Challenges with implementation capacity, skills, and climate finance

The Disaster and Emergency Management Presidency (AFAD) is the key organisation that produces national-level plans and undertakes activities with the aim of reducing risk and managing the impact of disasters and emergencies in Türkiye. **AFAD undertakes its activities at the Provincial level through Provincial Disaster and Emergency Directorates**. These are directly affiliated with Provincial governors and Disaster Affairs, and Fire Brigade Departments. The AFAD Provincial Directorate develops Disaster Risk Reduction Plans; however, **challenges of inadequate capacity, skills, and climate finance to implement climate and environmental policies remain a key issue for the Agency**.

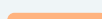
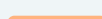
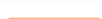
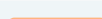
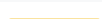
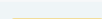
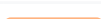
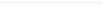
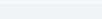
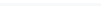
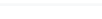
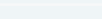
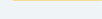
Lack of comprehensive data monitoring and sharing

AFAD collects and monitors disaster risk data; however, **there is a lack of data sharing and coordination between relevant organisations**. AFAD also produces flood risk maps, but only for limited areas near streams and rivers. Moreover, **there is a lack of monitoring and data collection related to specific climate change impacts and risks**. Methods such as remote sensing should be explored in further detail to develop a better understanding of challenges relating to urban heat and flooding, for example. These issues should then be taken into account when developing disaster response and adaptation plans.

48. Bursa Metropolitan Municipality, Climate Change Action Plan, (2015).

Gap in supply of green space and nature-based solutions to mitigate climate change effects

Although the per capita quantity of open space is relatively good across Bursa, as discussed above, **the increasing population numbers and changes in land use result in pressure on green spaces**. New green spaces are not being developed at a rapid enough pace to keep up with the growing demands. Moreover, nature-based solutions are used in a limited capacity, for example, street tree planting. Opportunities to incorporate best practices, such as green roofs and walls, rain gardens, retention ponds and swales, as part of existing and new green spaces and along rivers and streams exist. Such interventions would help to mitigate urban flooding, improve water quality, build urban heat resilience, sequester carbon and reduce GHG emissions.

Hazard	Likelihood	Magnitude	Overall rating	Sectors affected
EXTREME HEAT				Energy, Transport, Buildings, Land Use, Water resources
DROUGHT				Water, Land Use, Energy
EARTHQUAKES				Building, Transport, Water, Energy, Industry, Land Use
LANDSLIDES				Buildings, Water resources, Energy, Land Use, Transport
PLUVIAL FLOODING				Buildings, Energy, Water, Industry, Transport
ECONOMIC CRISIS				All sectors
AIR POLLUTION				Energy, Buildings
COASTAL POLLUTION				Water, Agriculture, Transport
SURFACE WATER POLLUTION (INCLUDING MUCILAGE)				Tourism infrastructure, Agriculture, Water
GROUNDWATER POLLUTION				Water, Agriculture
SOCIAL CONFLICTS				All sectors
RIVER FLOODING				Industry, Transport, Energy, Buildings
SEA-LEVEL RISE (COASTAL FLOODING)				Energy, Land Use, Transport, Buildings
WILDFIRE				Tourism infrastructure, Land Use, Buildings, Transport

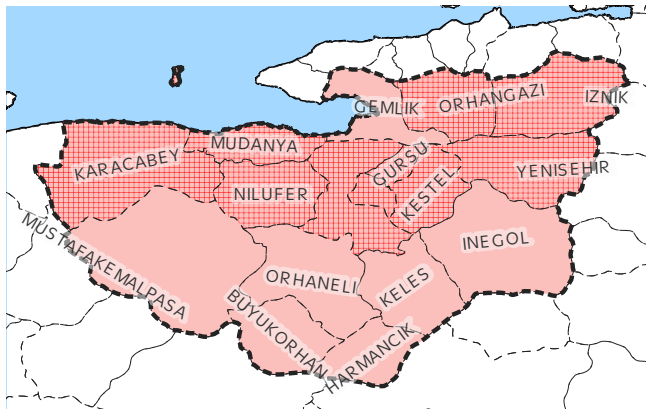
Likelihood
 Frequent
  Probable
  Occasional

Magnitude / Overall rating
 Severe
  Significant
  Moderate
  Low

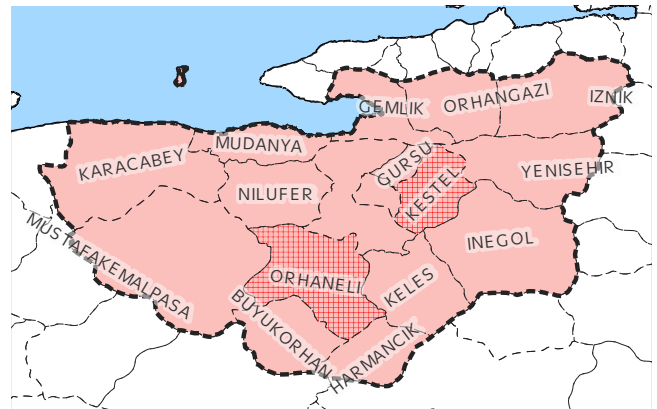
Table A12: Summary of Risk Assessment for Bursa
Source: AtkinsRéalis technical analysis

Geographic Distribution of Risks Across BMM Districts

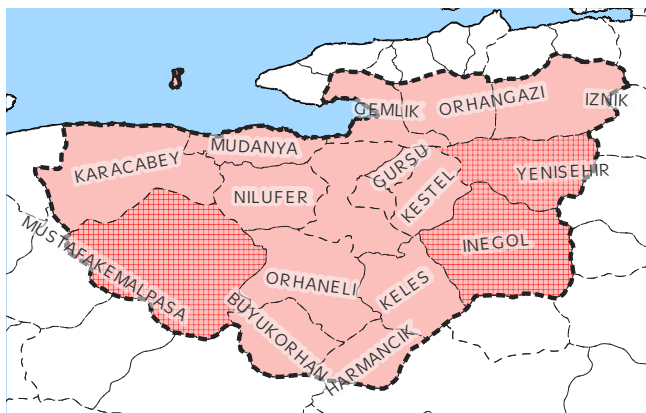
Extreme Heat



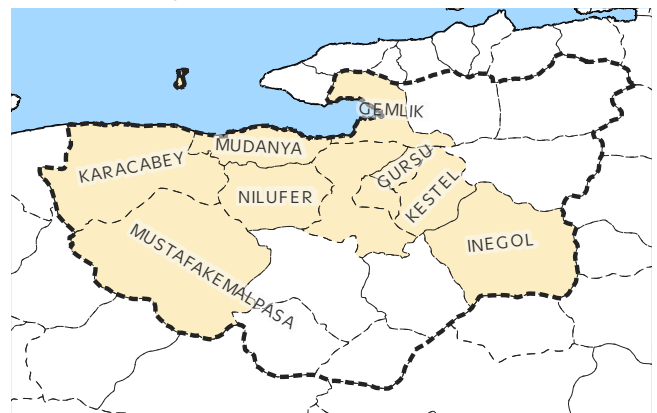
Drought



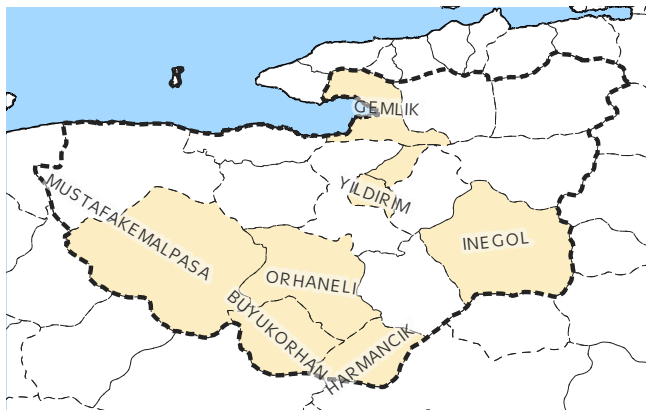
Earthquakes



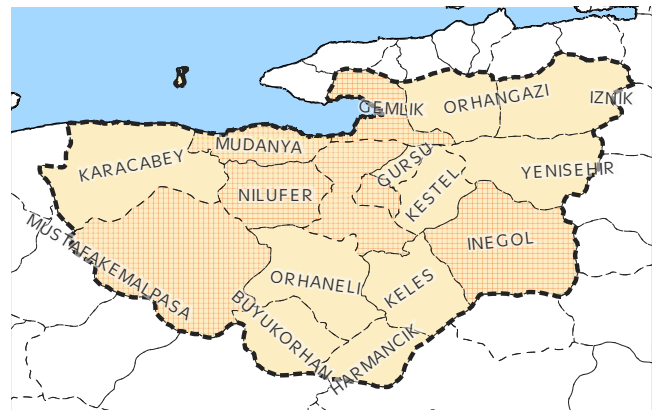
Pluvial Flooding



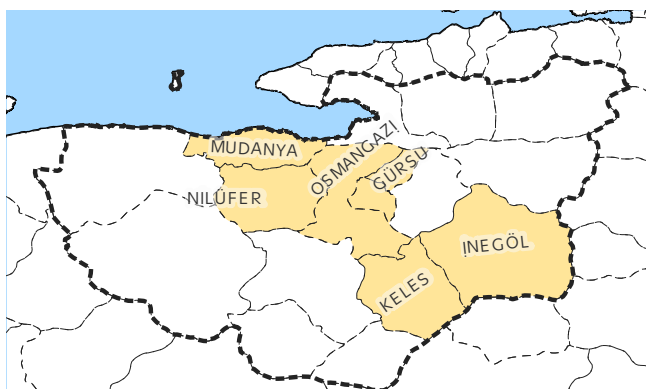
Landslide



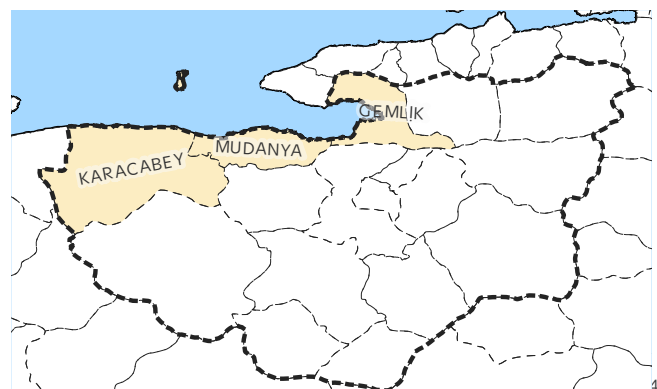
Economic Crisis



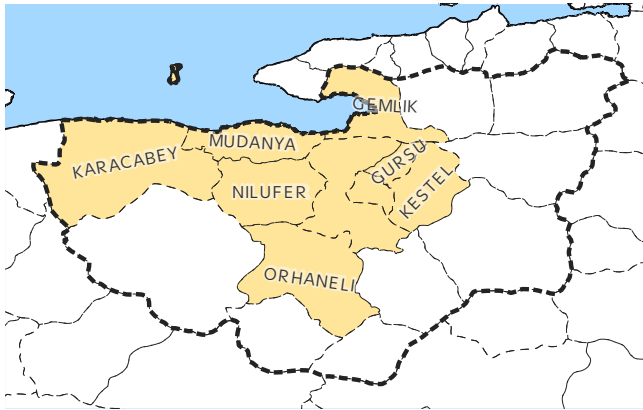
Air Pollution



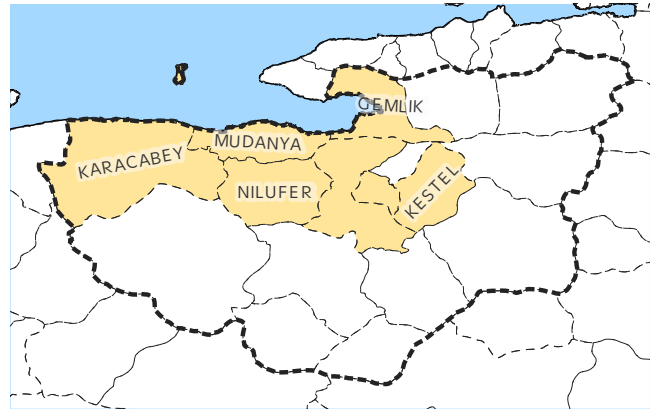
Coastal Pollution



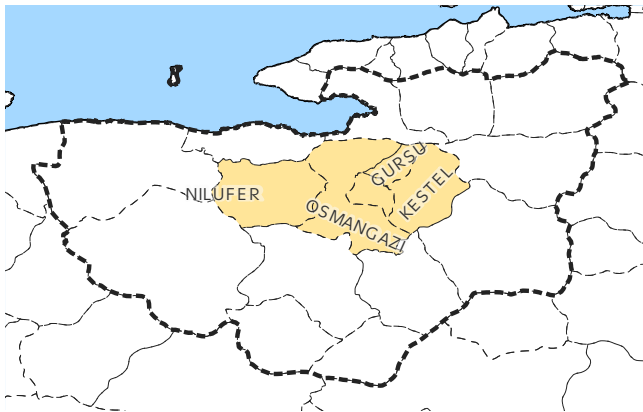
Surface Water Pollution



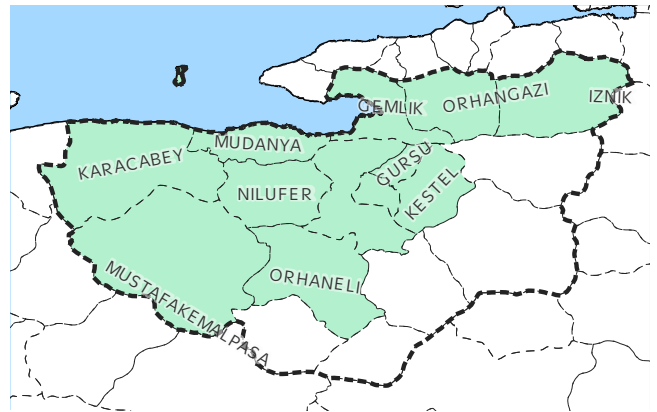
Ground Water Pollution



Social Conflict



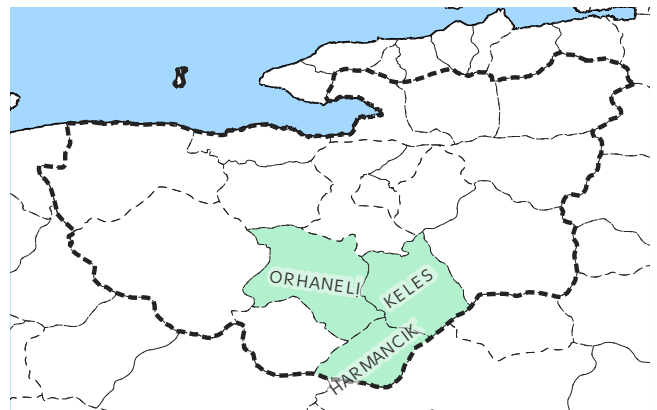
River Flooding



Sea Level Rise



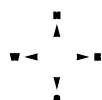
Wildfire



LEGEND

- BMM
- Districts
- Water bodies
- District with high significant risk
- District with high severe risk
- Risk
- Low
- Moderate
- Significant
- Severe

0 20 40 60 80 km



Municipal and Urban Infrastructure

OVERVIEW

The Technical Baseline Assessment evaluated the performance of the following municipal and urban infrastructure sectors: solid waste, industries, transport, land use, buildings, energy and water. A summary of the findings can be found below. Key findings from this detailed assessment have been summarised in this section, with the following key used to indicate various dimensions of performance.

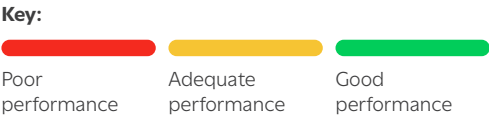


Table A14 indicates a summary of the performance of municipal and infrastructure sectors against the indicator database, baseline assessment and stakeholder perception. Further details relating to the topic baseline conditions are discussed in further detail below.

Urban Infrastructure Sector	Indicator benchmark ⁴⁸	Evaluated benchmark ⁴⁹	Stakeholder perception ⁵⁰	Overall
LAND USE				
BUILDINGS				
INDUSTRIES				
TRANSPORT				
WATER				
ENERGY				
SOLID WASTE				

Table A13: Summary of performance for urban infrastructure sectors
Source: AtkinsRéalis analysis based on technical expertise, relevant laws and stakeholder engagement during the GCAP development process.

49. Represents the average performance of indicators collected for the environmental topics as part of the Indicator Database.

50. Represents the conclusions and expert judgment of the international and local experts based on qualitative evidence and research conducted for the Technical Baseline Assessment report.

51. Represents stakeholder perceptions of sectoral performance, based on feedback gathered during the first and second stakeholder engagement workshops held in May and September 2024 respectively and an online survey undertaken in July and August 2024.

LAND USE

Urban growth and population density patterns

Bursa's **urban expansion has largely followed major transportation corridors along the east-west axis** between Ankara and İzmir. The dominance of this east-west axis is illustrated by the fact that the **city's built-up area spans approximately 1,000 km² along a 50 km stretch along this axis**. The population density is unevenly distributed across Bursa's districts. While **the urban core, particularly in the Yıldırım district, has high densities, other urban areas fall below the optimal threshold of 4,000 inhabitants per km² per EBRD's methodology**, reflecting an imbalanced urban growth pattern (as shown Figure A15).

Loss of green space and agricultural land

Rapid urbanisation in Bursa has also led to the **conversion of green spaces and agricultural lands into urban and industrial developments**, especially near the urban core, district centres, and tourist areas. The contrasting land use changes within Kestel district illustrate these dynamics. Near Kestel's urban areas, there has been **a significant decline in forest and agricultural areas, while the Aksu neighbourhood near the district's outskirts has witnessed a shift from agricultural land use to forest cover following rural depopulation**. This loss of arable agricultural land has broader implications for local food production and biodiversity.

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
DENSITY / INTEGRATED LAND USE				
33	POPULATION DENSITY ON URBAN LAND	1278 residents / km ²	2023	
33.1	AVERAGE COMMUTING DISTANCE	11.7 km	2018	
33.2	AVERAGE COMMUTING TIME	38.22 min	2018	
33.3	PROPORTION OF THE POPULATION LIVING WITHIN 20 MINUTES OF EVERYDAY SERVICES GROCERY STORES, CLINICS ETC.	98 %	2023	
URBAN SPRAWL				
34	AVERAGE ANNUAL GROWTH RATE OF BUILT-UP AREAS	1%	2021	
34.1	SHARE OF BROWNFIELD DEVELOPMENT	N/A	N/A	N/A
USE OF EXISTING BUILT-UP AREAS				
35	VACANCY RATES OF COMMERCIAL BUILDINGS	N/A	N/A	N/A
35.1	VACANCY RATES OF RESIDENTIAL BUILDINGS	N/A	N/A	N/A

Table A14: Performance on Land Use sector indicators

Data Sources: BMM Department of Transportation, BMM Department of Zoning and Urbanization and AtkinsRéalis technical analysis.

Alignment between spatial planning instruments

Bursa's **spatial planning operates on multiple tiers, including provincial Environmental Plans, Master Development Plans**, and detailed Zoning Plans developed by District Municipalities. However, inconsistencies and misalignments between these various scales have led to inefficient land management. Uncoordinated growth in residential and industrial areas, along with unauthorised settlements—particularly in Yildirim—has contributed to **discrepancies between planned land use and actual development patterns**.

Urban renewal and heritage conservation

Urban renewal efforts in Bursa are characterised by a fragmented approach, where projects often focus on individual structures without considering the wider urban context. The absence of a unified definition for urban transformation and the involvement of multiple public and private entities have led to initiatives that sometimes compromise the historical character of key districts. The example of the 2013 renewal project in Osmangazi's Doğanbey neighbourhood highlights challenges in preserving cultural heritage while undertaking urban redevelopment.

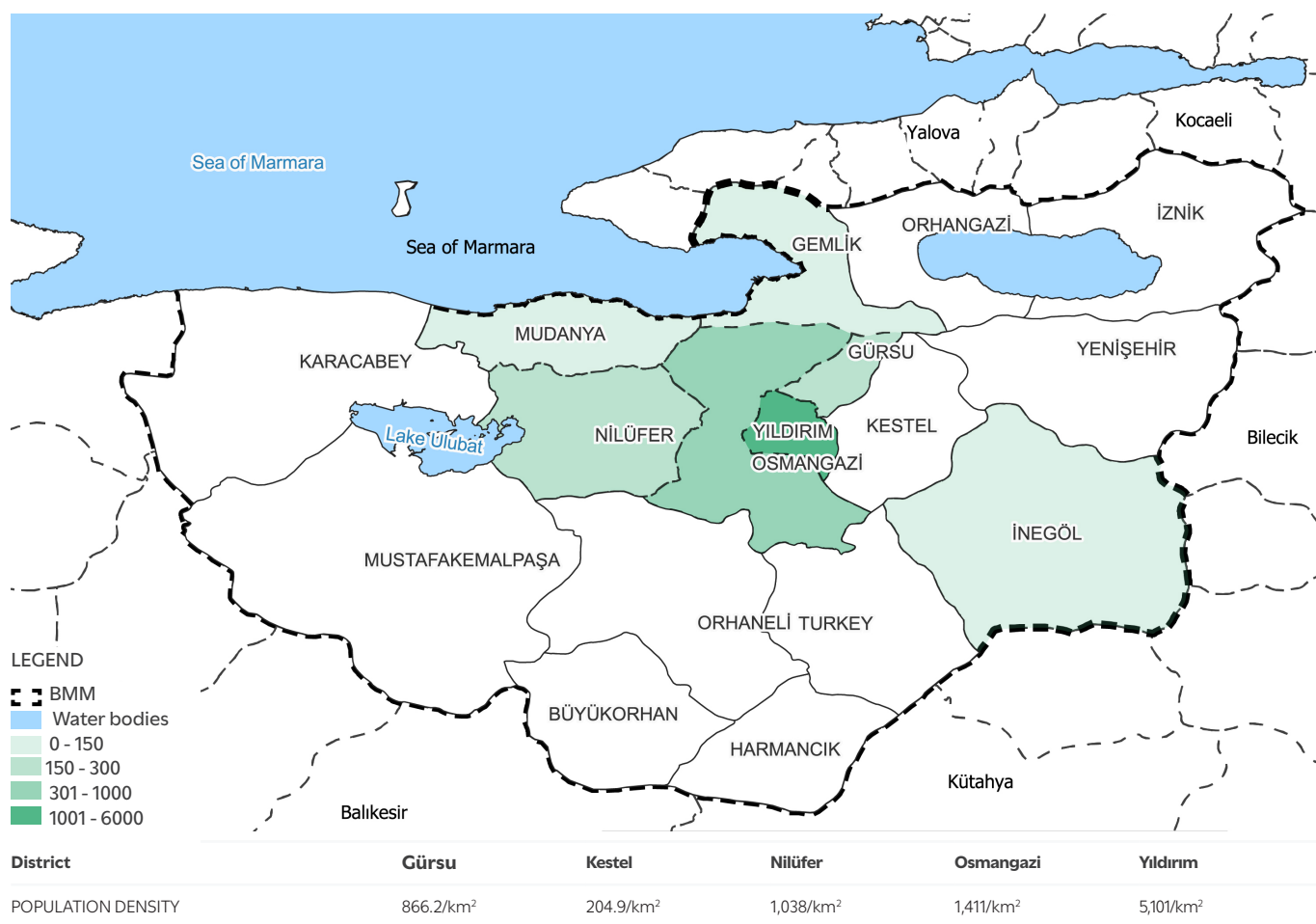


Figure A15: Population density of urban Districts in Bursa. Source: GCAP Bursa Technical Baseline Report, 2024

Source: AtkinsRéalis analysis, based on Census data

BUILDINGS

Energy usage and efficiency

Housing, electricity, and fuel use in the buildings sector accounted for 22% of Bursa's GHG emissions in 2020, making this sector the second-largest contributor to GHG emissions. Bursa's building stock is predominantly old, with **75% of buildings constructed before 2000**, requiring retrofits to meet seismic and energy efficiency standards. While progress has been made in raising awareness, in particular at the national level through the implementation of Energy Performance Certificates (EPCs), the Bursa faces challenges in retrofitting its ageing buildings to meet modern energy efficiency standards.

While commercial buildings rely more on electricity, **residential buildings are still heavily dependent on fossil fuels, particularly coal and natural gas, which make up 71% of their energy mix.** The widespread use of individual combination heating systems over central heating further contributes to inefficiency.

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
ELECTRICITY CONSUMPTION				
18	ELECTRICITY CONSUMPTION IN BUILDINGS	41 kWh / m ²	2023	
18.1	ELECTRICITY CONSUMPTION IN RESIDENTIAL BUILDING	15.36 kWh / m ²	2023	
18.2	ELECTRICITY CONSUMPTION IN COMMERCIAL BUILDINGS	80 kWh / m ²	2023	
	ELECTRICITY CONSUMPTION IN PUBLIC BUILDINGS	117,048 kWh / m ²	2023	
THERMAL COMFORT BY BUILDING TYPE				
19	FOSSIL FUELS CONSUMPTION FOR HEATING AND COOLING	N/A	N/A	N/A
19.1	FOSSIL FUELS CONSUMPTION FOR HEATING AND COOLING IN RESIDENTIAL BUILDINGS	N/A	N/A	N/A
19.2	ANNUAL FOSSIL FUELS CONSUMPTION FOR HEATING AND COOLING IN COMMERCIAL BUILDINGS	N/A	N/A	N/A
19.3	FOSSIL FUELS CONSUMPTION FOR HEATING AND COOLING IN PUBLIC BUILDINGS	N/A	N/A	N/A
BUILDING STANDARDS				
19.4	SHARE OF NEW BUILDINGS WITH GREEN CERTIFICATION	N/A	N/A	N/A
19.5	SHARE OF BUILDINGS WITH ENERGY PERFORMANCE CERTIFICATES (EPC)	N/A	N/A	N/A

Table A15: Performance on Buildings sector indicators

Data Sources: Energy Market Regulatory Authority (EPDK)

Challenges with regulatory framework and compliance

Türkiye has a comprehensive legal framework governing building construction, demolition, and energy efficiency. Key regulations include the Energy Performance Regulation in Buildings, which mandates a minimum Class C energy performance rating for new buildings since 2011 and requires EPCs for all property transactions. However, **older buildings are not subject to performance class requirements, contributing to low compliance levels, particularly in residential sectors.** Additionally, there is **no legislation requiring continuous monitoring and improvement of energy and carbon performance in existing buildings.**

Non-compliant construction is also a critical challenge in Bursa, particularly in the Osmangazi and Yıldırım districts, where a high proportion of vulnerable buildings require attention. Approximately 92.86% of Bursa's unauthorised settlements are in high-risk zones, located in geologically hazardous areas, increasing disaster risks.

Heritage and urban renewal

Bursa has preserved much of its historical buildings, particularly in districts such as Hisar, Reyhan, and Muradiye, which have several examples of traditional Ottoman architecture, including 20 urban sites, 144 archaeological sites, and five mixed sites. Conservation efforts have been ongoing since the 1960s, but have often resulted in the **reconstruction of landmark buildings rather than the preservation of their unique attributes.** As repeatedly highlighted by stakeholders during consultation, the Doğanbey TOKİ Residences project exemplifies the challenges of urban transformation, where **high-rise developments disrupted the social fabric and historical character of the area.** Public awareness and understanding of urban renewal remain limited, with financial constraints and redevelopment priorities influencing decision-making.

Lack of inventory of building stock

Despite the residential sector's significant contribution to GHG emissions in Bursa, there is a lack of comprehensive data on its energy efficiency and emissions. While approximately 1.5 million buildings in Türkiye have received an EPC, anecdotal evidence from stakeholder engagement activities in May 2024 suggests that 80% of Bursa's buildings do not have an energy identification certificate. **The overall energy efficiency of most existing building typologies remains unknown,** highlighting the need for improved monitoring and data collection.

INDUSTRIES

An industrial powerhouse for Türkiye

Bursa has played a significant role within the industrial sector in Türkiye for several decades. **It hosts the first Organised Industrial Zones (OIZ) in Türkiye, set up in the 1960s.** As indicated in Figure A16, **Bursa hosts 17 OIZs, with an 18th being planned and accounts for 1/5 of all OIZs in the Marmara Region.** Bursa is also home to several major industries and production facilities, specifically in the automotive industry with the TOFAŞ, TOGG and Oyak-Renault factories being located there, as well as textiles, agriculture and food processing plants, machinery and manufacturing plants, and cement and mining. **Bursa is also home to a large number of small and medium businesses,** which are often located outside the OIZs in other industrial areas spread across the Province. Such industries have been shown to **have a largely negative impact on the local environment, including air quality, ground and surface water quality,** in particular the Nilüfer Stream, soil quality, and GHG emissions.

Industrial land uses and proximity to residential areas

Given the expansion of the city over time, **many OIZs and industrial zones which were previously found outside of the city boundaries have now been surrounded by residential and commercial development.** This has resulted in many residents living directly adjacent to large industrial areas, especially in Nilüfer and Kestel Districts. Moreover, the growth of industrial areas over time has resulted in the loss of highly productive agricultural land and natural areas.

Complex jurisdiction of infrastructure delivery

When compared to most other infrastructure sectors, the industries sector has a complex network of various infrastructure and service providers/operators. This limits BMM's powers and responsibilities in implementing actions in the industry sector. **OIZs**

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
INDUSTRIAL ELECTRICITY CONSUMPTION				
20	ELECTRICITY CONSUMPTION IN INDUSTRIES, PER UNIT OF INDUSTRIAL GDP	0.249 kWh / 2010 USD	2023	
INDUSTRIAL HEAT CONSUMPTION				
21	HEAT CONSUMPTION IN INDUSTRIES, PER UNIT OF INDUSTRIAL GDP	1.317 MJ / 2010 USD	2023	
CONSUMPTION OF FOSSIL FUEL IN INDUSTRIAL PROCESSES				
22	HEAVY METALS (PB) EMISSION INTENSITY OF MANUFACTURING INDUSTRIES	N/A	N/A	N/A
22.1	FOSSIL FUEL COMBUSTION IN INDUSTRIAL PROCESSES, PER UNIT OF INDUSTRIAL GDP	N/A	N/A	N/A
22.2	SHARE OF INDUSTRIAL ENERGY CONSUMPTION FROM RENEWABLE ENERGY	48.95 %	2023	
INDUSTRIAL WASTE TREATMENT				
23	SHARE OF INDUSTRIAL WASTE RECYCLED AS A SHARE OF TOTAL INDUSTRIAL WASTE PRODUCED	N/A	N/A	N/A
INDUSTRIAL WASTEWATER				
24	PERCENTAGE OF INDUSTRIAL WASTEWATER THAT IS TREATED ACCORDING TO APPLICABLE NATIONAL STANDARDS	56 %	2023	
	TOTAL AMOUNT OF INDUSTRIAL WASTE THAT IS TREATED ACCORDING TO APPLICABLE NATIONAL STANDARDS	47,894,199 m³	2023	N/A

Table A16: Performance on Industries sector indicators

Data Sources: Energy Market Regulatory Authority (EPDK), TEIAS and BUSKI

are typically designated and developed by the national government in consultation with BMM, with infrastructure provision and services being managed by individual management agencies for each OIZ. When it comes to solid waste management, private companies collect industrial waste, which is often transported outside Bursa for treatment and disposal. **Many industries source their own water via groundwater wells, while wastewater is treated at dedicated treatment plants in OIZs or transported to municipal treatment works.** Therefore, BMM can mainly influence the sector through the planning and zoning regulations it implements, as well as providing technical assistance and capacity-building activities to industries and businesses aimed at implementing best practices in environmental impact mitigation.

Progress towards sustainable practices

Several existing activities within the industries sector demonstrate progress in sustainable practices and efforts to reduce environmental impact, including the implementation of rooftop solar on a significant proportion of industrial buildings, dedicated wastewater treatment plants as part of OIZs and the development of the Bursa Green OIZ Action Plan. However, key challenges, including **ageing industrial building stock, lack of data relating to energy efficiency, inefficient energy use in industrial processes and low levels of alternative water and treated effluent reuse**, continue to contribute to environmental degradation.

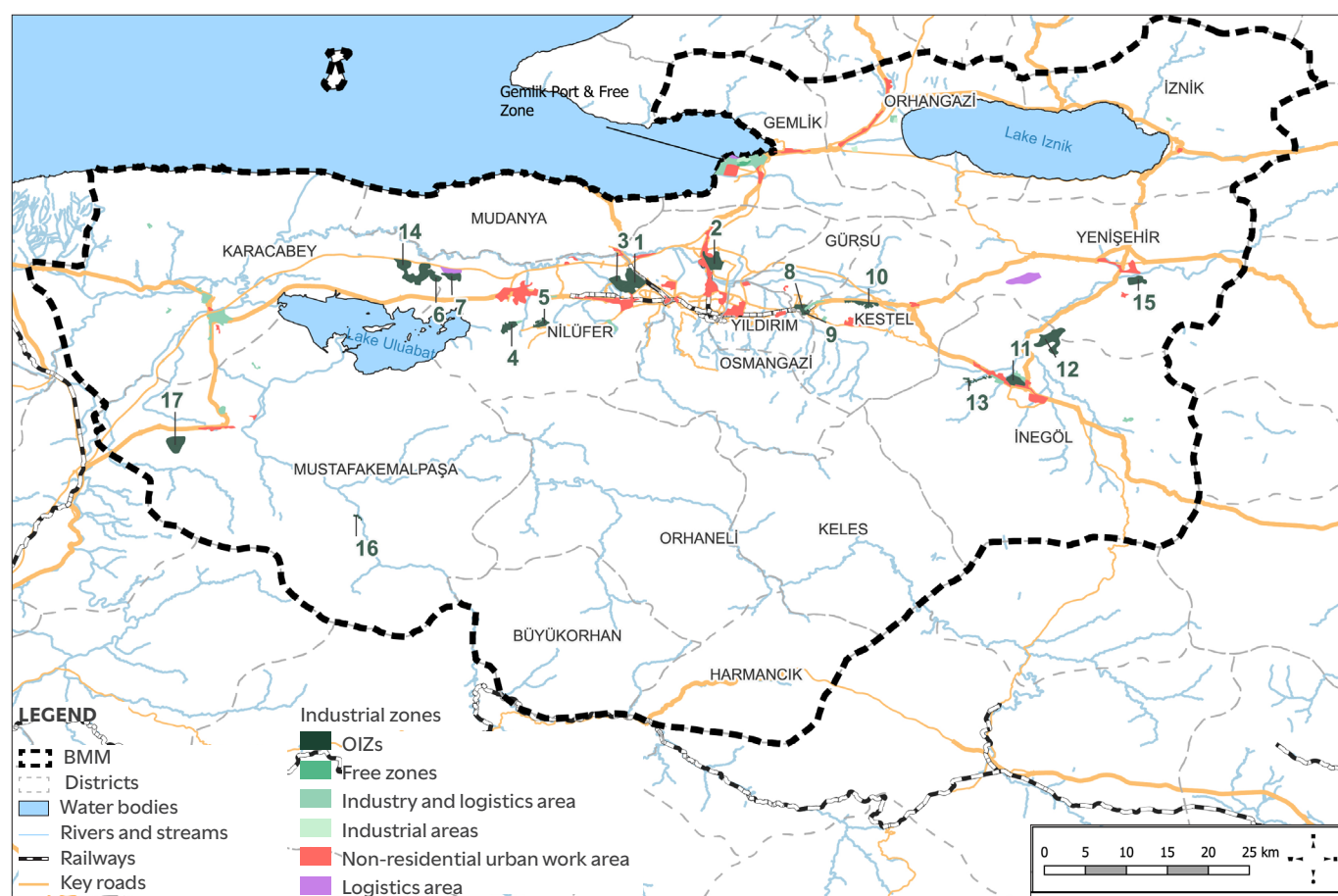


Figure A16: Map of industrial areas across BMM

Data Sources: AtkinsRéalis analysis based on the 1/100,000 environmental plan.

TRANSPORT

Integrating and expanding public transport

Bursa's public transport network includes bus systems, rail systems, and maritime transport, operated by a combination of public and private entities. To address the growing need for improved public transport provision, **Bursa plans to expand its LRT and tramline network from 47.1 km in 2023 to 131.5 km by 2035, with further investments in metro infrastructure.**

Efforts to improve **the integration of Bursa's transport system include the implementation of a single card payment system** in some public

transport services and the introduction of dynamic pricing for infrastructure bottlenecks such as parking areas, bridges, tunnels, and park-and-ride facilities. In September of 2024, BursaRay introduced a "pay-as-you-go" system with fare adjustments based on distance travelled, which does not apply to journeys that begin on buses or to the T2 Tramline, limiting its integration across transport modes.

Despite some progress, the transport system is not yet fully integrated, and **further efforts are needed to ensure seamless connections** between different modes, improve accessibility, and encourage a transition towards more sustainable and energy-efficient transport options.

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
ENERGY EFFICIENCY AND TYPE OF ENERGY USED				
10	AVERAGE AGE OF THE VEHICLE FLEET (BY NUMBER AND TYPE)	12.58	2023	
10.1	PERCENTAGE OF DIESEL CARS IN TOTAL VEHICLE FLEET	35.60%	2023	
10.2	FUEL STANDARDS FOR LIGHT PASSENGER AND COMMERCIAL VEHICLES	EURO 6	2023	
10.3	SHARE OF TOTAL PASSENGER CAR FLEET RUN BY ALTERNATIVE ENERGY (TOTAL AND BY TYPE)	17 %	2023	
CHOICE OF TRANSPORT MODE				
11	TRANSPORT MODAL SHARE IN COMMUTING CARS MOTORCYCLES TAXI BUS METRO TRAM BICYCLE PEDESTRIAN	54.4 %	2018	
11.1	TRANSPORT MODAL SHARE IN TOTAL TRIPS	71 %	2018	
11.2	MOTORISATION RATE	0.19 vehicles per capita	2023	
11.3	AVERAGE NUMBER OF VEHICLES CARS AND MOTORBIKES PER HOUSEHOLD	0.6 vehicles per household	2023	
11.4	KILOMETRES OF ROAD DEDICATED EXCLUSIVELY TO PUBLIC TRANSIT PER 100000 POPULATION	1.47 km	2023	
11.5	TOTAL KILOMETRES OF DEDICATED BICYCLE PATH PER 100000 POPULATION	11.07 km	2023	
11.6	SHARE OF POPULATION HAVING ACCESS TO PUBLIC TRANSPORT WITHIN 15MIN BY FOOT	95 %	2023	
ROAD CONDITIONS AND CONGESTION				
12	AVERAGE TRAVEL SPEED ON PRIMARY THOROUGHFARES DURING PEAK HOUR	30 km/hour	2023	
12.1	TRAVEL SPEED OF BUS SERVICE ON MAJOR THOROUGHFARES DAILY AVERAGE	50 km/hour	2023	
RESILIENCE OF TRANSPORT SYSTEM				
13	INTERRUPTION OF PUBLIC TRANSPORT SYSTEMS IN CASE OF DISASTER	N/A	N/A	
13.1	EFFICIENCY OF TRANSPORT EMERGENCY SYSTEMS IN CASE OF DISASTER	N/A	N/A	

Table A17: Performance on Transport sector indicators

Data Sources: BMM Department of Transportation, TURKSTAT and BURULAS

Catalysing a transition towards lower-emission transport modes

Bursa's transport patterns indicate a shift towards private car usage, with the share of public transport decreasing. If this trend continues, the modal share of private transport may further increase, leading to a transition away from lower-emission transport modes. **While walking accounts for 42% of trips in the city, narrow sidewalks in historic areas and densely built environments limit pedestrian mobility.** Additionally, the high number of taxis and inefficient management practices contribute to poor local air quality. Bursa's transportation infrastructure is also vulnerable to disaster risks, including earthquakes, landslides, and flooding, which can disrupt mobility and damage critical transport routes.

Bursa has made efforts to **expand low-emission transport options, particularly in cycling infrastructure, but challenges remain in implementation and quality.** There are currently 356 km of bicycle paths within the city, but many of these lanes have been created by simply changing the paving colour of sidewalks, rendering them substandard and unsuitable for safe use. The city has also implemented a smart bike rental system, NILESPIT, in Nilüfer District. While initiatives to promote cycling exist, further improvements in the quality, safety, and connectivity of infrastructure are necessary to support widespread adoption.

WATER

Efforts in sustainable water management and infrastructure development

BUSKI, the affiliated institution of BMM that supplies potable water and carries out wastewater treatment, have made substantial efforts to reduce Non-Revenue Water (NRW) across the province. **At just under 20%, Bursa's urban core has one of the lowest NRW rates in Türkiye**, well below the national average of 32% reported in 2023⁵¹. This achievement is complemented by **ambitious projects designed to secure the potable water supply for the city's population until 2040 and beyond** through the exploration of new water sources and the construction of dams. Such efforts will need to continue given the anticipated impacts of climate change on reducing the availability of water resources. Additionally, BUSKI has a strong relationship with the EBRD. EBRD's ongoing support to BUSKI under the 'Bursa Water Project' includes the construction of a new drinking water treatment plant and new transmission lines, and demonstrates BUSKI's commitment to sustainable water management and infrastructure development.

Challenges with water use in rural districts

While indicators show an overall positive picture of the state of the water sector in urban districts of Bursa, the **main challenges exist across the rural districts** in the Province. **NRW in some Districts outside the urban core is 46% and flood irrigation continues to be a common practice among agricultural irrigation methods.** Moreover, there is a lack of monitoring and enforcement of regulations regarding groundwater extraction used for agriculture and industry. Such challenges undermine existing efforts being made by BUSKI to secure sustainable water resources and need to be addressed.

Need for investment in infrastructure to align with new regulations

Given the adoption of the new National Water Efficiency Regulation (2024)⁵² and revisions to the European Union's Urban Wastewater Treatment Directive (2025)⁵³, **BUSKI will need to continue investing in its potable water and wastewater treatment infrastructure to comply with new rules and standards.** Notably, by 2039, tertiary treatment of wastewater will need to be applied in all urban wastewater treatment plants (WWTPs) covering 150,000 people equivalent or above; this requirement will extend to any WWTPs covering 10,000 people equivalent by 2045. The transition of wastewater

treatment plants in the region towards advanced treatment processes and promoting the reuse of treated effluent is also a key part of the Marmara Sea Action Plan. These **new rules and standards aim to reduce nitrogen and phosphorus entering the local environment.** Moreover, the new regulation and directive require the country to **promote the reuse of treated wastewater effluent for all urban WWTPs**, especially in areas of high-water stress.

52. <https://www.suverimlijigi.gov.tr/en/urban-water-efficiency/>

53. <https://www.resmigazete.gov.tr/eskiler/2024/12/20241227-3.htm>

54. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024L3019&qid=1734080677883>

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
WATER CONSUMPTION, SUPPLY, PRODUCTION AND STORAGE				
25	DOMESTIC WATER CONSUMPTION PER CAPITA	162 L	2023	
25.1	NON-REVENUE WATER (IN THE URBAN CORE)	19.5 %	2023	
25.2	ANNUAL AVERAGE OF DAILY NUMBER OF HOURS OF CONTINUOUS WATER SUPPLY PER HOUSEHOLD	24	2023	
25.3	ENERGY USED FOR URBAN WATER PRODUCTION AND SUPPLY	0.3 kWh/m ³	2023	
25.4	POTABLE WATER STORAGE	1.1 day	2023	
25.5	WATER CONSUMPTION PER UNIT OF CITY GDP	N/A	N/A	N/A
25.6	SHARE OF INDUSTRIAL WATER CONSUMPTION	6.8 %	2023	
WASTEWATER CONVEYANCE, TREATMENT AND SLUDGE				
26	PERCENTAGE OF RESIDENTIAL AND COMMERCIAL WASTEWATER THAT IS TREATED ACCORDING TO APPLICABLE NATIONAL STANDARDS	86.8 %	2023	
26.1	PERCENTAGE OF NON-INDUSTRIAL BUILDINGS EQUIPPED TO REUSE GREY WATER	N/A	N/A	N/A
26.2	PERCENTAGE OF WASTEWATER FROM ENERGY GENERATION ACTIVITIES THAT IS TREATED ACCORDING TO APPLICABLE NATIONAL STANDARDS	N/A	N/A	N/A
27	SEWER NETWORK INTEGRITY (PIPE BREAK)	N/A	N/A	N/A
	TOTAL NUMBER OF SEWER FAILURES REPORTED	111.769 / year	2023	N/A
27.1	ENERGY USED FOR WASTEWATER COLLECTION AND TREATMENT	0.27 kWh/m ³	2023	
27.2	SLUDGE SAFELY TREATED AND DISPOSED OF OR SAFELY USED	100 %	2023	
RESILIENCE TO FLOODING				
28	PERCENTAGE OF DWELLINGS DAMAGED BY THE MOST INTENSE FLOODING IN THE LAST 10 YEARS	N/A	N/A	N/A
28.1	ANNUAL NUMBER OF HEAVY STORMS OR SEWERAGE OVERFLOWS PER 100 KM OF PIPING NETWORK	N/A	N/A	N/A

Table A18: Performance on Water sector indicators

Data Sources: BUSKI and TURKSTAT

ENERGY

High reliance on fossil fuels

More than **two-thirds of the installed electricity generation capacity in Bursa relies on fossil fuel as an energy source**. Natural gas accounts for 63% of fuel used for electricity generation, while lignite coal accounts for another 7%. In addition to being used at the Orhaneli Thermal Power Plant, coal is also used as a source for heating in some low-income households across the Province.

Untapped opportunity for renewable energy generation

Only one-third of installed electricity generation capacity is renewables-based, and **renewable energy only accounts for 19.3% of the total energy consumption across the Province**, despite Bursa being rich in renewable energy sources. Wind power makes up the largest share of renewables at 15%, followed by hydroelectric at 6%, solar at 6% and biogas at just 1% of generation capacity. **Biomass remains a key untapped source of renewable energy**, given the quantity of agricultural waste from vegetables, crops, and animals, industrial food processing waste, and municipal waste production in Bursa.

No.	Indicator	Value + unit	Year	Performance per EBRD benchmark
ENERGY PROVISION				
14	SHARE OF POPULATION WITH AN AUTHORISED CONNECTION TO ELECTRICITY	N/A	N/A	N/A
14.1	ELECTRICAL INTERRUPTIONS	18.60 (#/year/ customer)	2023	
14.2	PERCENTAGE OF NETWORK LINE LOSSES	52.30 %	2021	
	TOTAL NUMBER OF SUBSCRIBERS WITH A LEGAL CONNECTION	3,651,540	2023	N/A
THERMAL COMFORT BY SECTOR				
15	SHARE OF POPULATION WITH ACCESS TO QUALITY HEATING / COOLING	93.60 %	2023	
15.1	SHARE OF HOUSEHOLDS CONNECTED TO DISTRICT HEATING	N/A	N/A	N/A
15.2	SHARE OF DISTRICT HEATING FROM CARBON INTENSIVE SOURCES	N/A	N/A	N/A
15.3	SHARE OF DISTRICT HEATING FROM LESS CARBON INTENSIVE SOURCES	N/A	N/A	N/A
15.4	SHARE OF DISTRICT HEATING FROM RENEWABLE SOURCES	N/A	N/A	N/A
	POPULATION CONNECTED TO SMALL-SCALE/CENTRALISED HEATING SYSTEMS	10 %	2023	N/A
RENEWABLE ENERGY				
	PERCENTAGE OF HOUSEHOLDS RELYING ON COAL OR WOOD FOR HEATING	4-6 %	2024	N/A
16	AVERAGE SHARE OF RENEWABLES IN TOTAL ENERGY CONSUMPTION	19.3 %	2023	
ENERGY NETWORK				
17	POWER OUTAGES CAUSED BY CLIMATE EXTREMES	24.95 %	2023	

Table A19: Performance on Energy sector indicators

Data Sources: Energy Market Regulatory Authority (EPDK), TURKSTAT, TEIAS

Ageing distribution infrastructure

The **distribution network experiences high levels of electricity interruptions and a high percentage of losses** as a result of ageing infrastructure, incoherent maintenance work, and climate extremes, in particular extreme heat, which impacts overhead lines and auxiliary infrastructure.

Limited opportunity for intervention

BMM has limited influence over how the Energy sector is governed and operated, due to the top-down and privatised nature of the sector. The National Government sets the vision and policy for energy development and private companies, such as EUAS or TEIAS, undertake energy generation and transmission. Despite this, the Municipality can play a key role in raising awareness and building capacity to promote a shift towards more efficient energy use among its citizens, as well as work with partners to decarbonise their own energy use by implementing renewable energy solutions.

SOLID WASTE

Bursa's solid waste sector performs relatively well compared to other cities in Türkiye. The province benefits from regular household waste collection services and there are several well-functioning treatment and disposal sites, including the Eastern Region Solid Waste Disposal Facility in İnegöl district and the Yenikent Solid Waste Landfill.

Insufficient source separation, recovery and disposal

Although various initiatives and awareness-raising activities have been carried out across the province to promote waste reduction and recycling, **source separation of waste remains limited.** As of 2023, the proportion of dry recyclables, comprising of paper, cardboard, plastic, glass, metal, wood, and textile waste within municipal waste, was reported at around 2% - below EBRD's 'yellow' benchmark of 15% indicating insufficient performance, and well below the 'green' benchmark of 35% which indicates good performance in line with international standards. However, as highlighted by BMM stakeholders, this rate reflects only the share of recyclable waste collected by municipalities. There are also additional methods for recycling across the Province **the figure may be higher following the implementation of the Zero Waste Regulation**, which mandates buildings and settlements to establish zero waste management systems, gives opportunity to separate their own waste and drop this off at certified/licensed processing facilities in addition to the collection system of local authorities. **Some proportion of dry recyclables may be processed in other facilities** – this is estimated at around 2.5% by BMM; however, official data may not include this figure. Additionally, this figure does not include **recyclable waste recovered by informal waste pickers, estimated at around 5% of total recyclable waste** in BMM's 2022 Integrated Solid Waste Management Plan.

Coordination of solid waste management activities

Solid waste management in Bursa falls under the remit of multiple stakeholders. District municipalities are responsible for the collection of municipal waste, while Bursa Metropolitan Municipality is responsible for the transfer, disposal, and processing of this waste. The management of industrial waste is carried out by private sector companies under contractual agreements. **The lack of coordination among these stakeholders has been identified by Bursa stakeholders as one of the key challenges** in establishing an integrated solid waste management system across the province and for implementing circular economy principles. This is further evidenced by the low proportion of municipal solid waste treated in sorting, processing and treatment plants – at 24%, this proportion is just under EBRD’s ‘yellow’ benchmark of 25% and ‘green’ benchmark of 75% for this indicator.

Significant environmental impact of current waste management practices

Efforts to monitor and mitigate the impacts of the solid waste sector on Bursa’s environment have been made, including leachate collection and treatment from the sanitary landfill sites and regular monitoring of leachate, groundwater and surface water in line with applicable regulations. However, **while most household waste is disposed of in integrated facilities and sanitary landfill sites, there are also several open and uncontrolled waste disposal sites.** Efforts to rehabilitate these are underway but these continue to have a negative impact on local biodiversity, soil and water quality, as well as utilisation of land for public benefit. This situation underscored the need for continuous improvement of waste management practices to reduce adverse impacts on the natural environment.

No.	Indicator	Value	YEAR	Performance per EBRD benchmark
SOLID WASTE GENERATION AND COLLECTION				
29	TOTAL MUNICIPAL SOLID WASTE GENERATION PER CAPITA	377 kg/year/capita	2023	
30	WASTE COLLECTION SERVICE COVERAGE RATE	100 %	2023	
30.1	PROPORTION OF DRY RECYCLABLES	2 %	2023	
30.2	PROPORTION OF ORGANIC WASTE	40.6 %	2023	
SOLID WASTE TREATMENT AND DISPOSAL				
31	MUNICIPAL SOLID WASTE TREATED IN SORTING, PROCESSING AND TREATMENT PLANTS	24 %	2023	
31.1	PERCENTAGE OF MSW WHICH IS DISPOSED OF IN OPEN DUMPS-CONTROLLED DUMPS OR BODIES OF WATER OR IS BURNT	0.5 %	2023	
31.2	MUNICIPAL SOLID WASTE DISPOSED IN EU-COMPLIANT/EQUIVALENT SANITARY LANDFILLS	99.5 %	2023	
32	REMAINING LIFE OF CURRENT LANDFILLS			
	İNEGÖL SOLID WASTE FACILITY	13 years	2024	
	YENİKENT SOLID WASTE LANDFILL	3 years	2024	

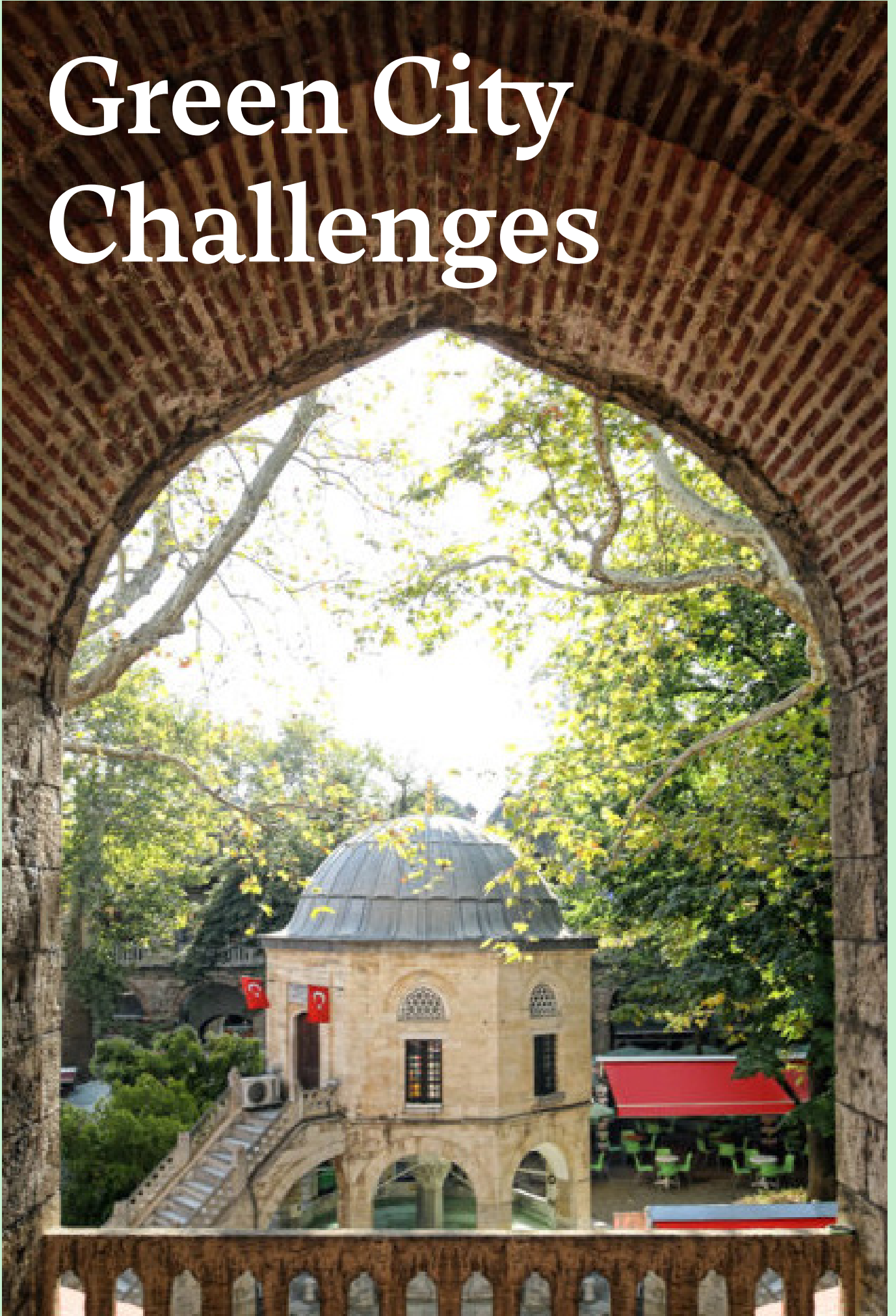
Table A20: Performance on Solid Waste sector indicators

Data Sources: BMM Department of Environmental Protection and Control and TURKSTAT

Challenges in implementing some Integrated Solid Waste Management projects

Over the past decade, BMM has faced challenges in implementing certain solid waste management projects. **Delays in the implementation of the Western Region Integrated Solid Waste Disposal Facility** have increased the pressure on existing processing and disposal facilities, while also raising inter-facility waste transportation costs. According to BMM's Integrated Solid Waste Management Plan, **the Yenikent Solid Waste Landfill is expected to reach the end of its life in 2027** – below EBRD's global benchmark of 5 years for satisfactory performance on this indicator. However, as noted during stakeholder consultation and observed through site visits, **BMM has taken several measures to extend the usable life for this landfill by a few years** (e.g., implementing improved management practices and transferring waste to the İnegöl Eastern Region Integrated Solid Waste Disposal Facility). The establishment of new transfer stations and processing facilities is of strategic importance for improving the operational efficiency of the sector.

Green City Challenges



Koza Han, Osmangazi

Green City Challenges are **policy, planning and infrastructural challenges in the eight sectors that have been prioritised by stakeholders as having the most significant contributions to environmental degradation in Bursa.** These challenges form the basis of identification, prioritisation, and development of Green City Actions.

This chapter summarises the Green City Challenges identified and prioritised after technical assessment of the baseline and stakeholder consultation, and the interlinkages between these Challenges within Bursa's context.

Summarised overleaf is a full list of **sectoral challenges derived from the technical assessment of Bursa's environmental baseline condition** carried out by technical experts between June and August 2024. Sectoral challenges were then validated with nearly **150 representatives from civil society organisations, academic organisations, and senior staff from various BMM departments and utility companies across eight Sectoral Meetings** held in Bursa from 9-11 September 2024. Through voting and discussions at each sectoral meeting, **participants collectively prioritised Bursa's Green City Challenges**, highlighted in bold text.

As illustrated in Figure A17, there are four main pressure drivers that impact each GCAP sector and indirectly lead to environmental impacts – these include: **Bursa's climate and physical geography, historic legacy of urbanisation, rapid population growth** and its **position in the Country as a hub for industrial development**.

Each of these **pressure drivers affects, directly and indirectly, the performance of each sector**. Further exacerbating the impacts of these pressure drivers are direct and indirect interdependencies between the sectors, as illustrated through the following examples:

- Bursa's **climate and physical geography have influenced its position, growth and urban morphology over time**. The city lies in a region vulnerable to climate change-induced droughts, extreme heat and seismic risk due to its location near a major fault line. Prevailing north-south winds tend to exacerbate seasonal air pollution.

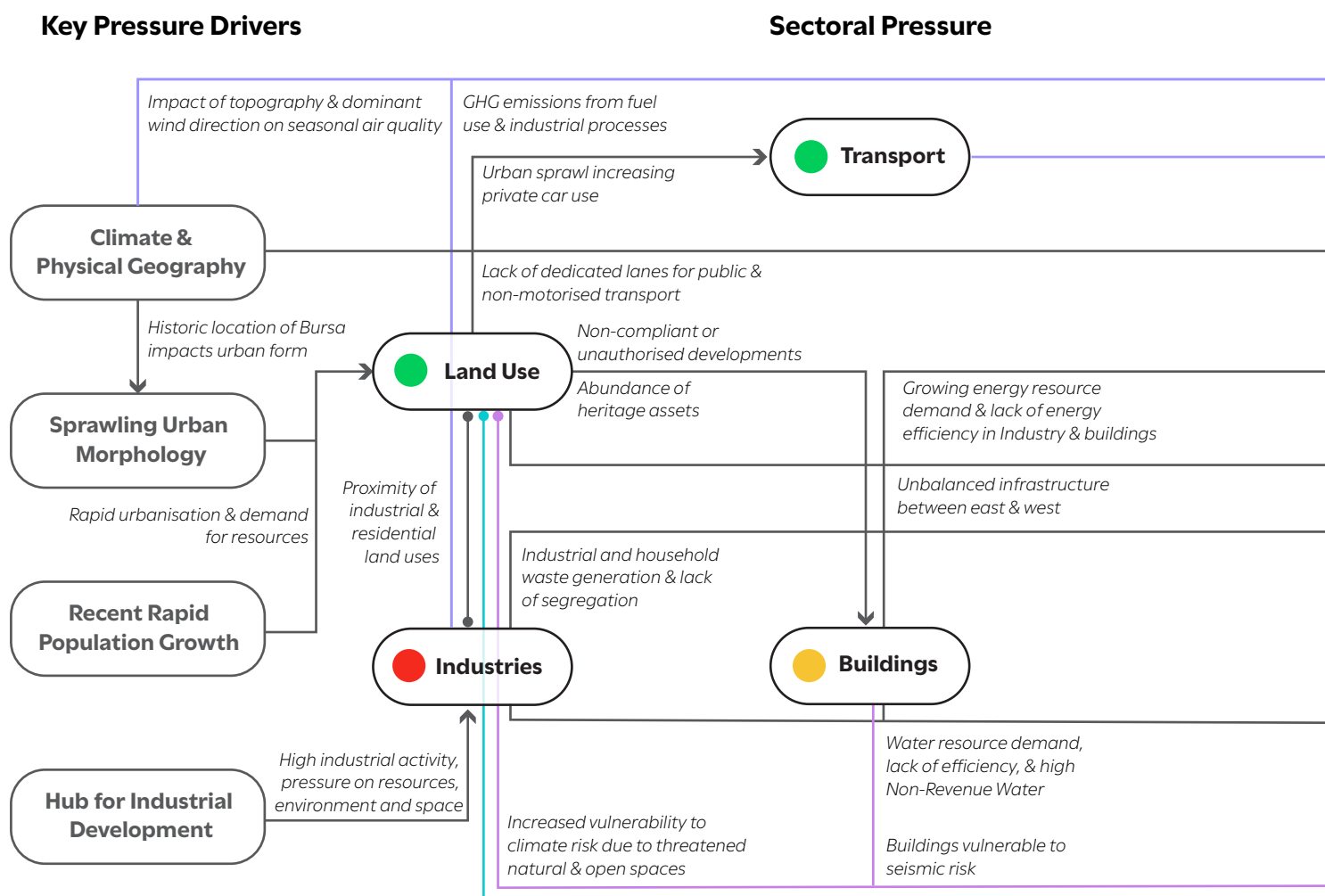


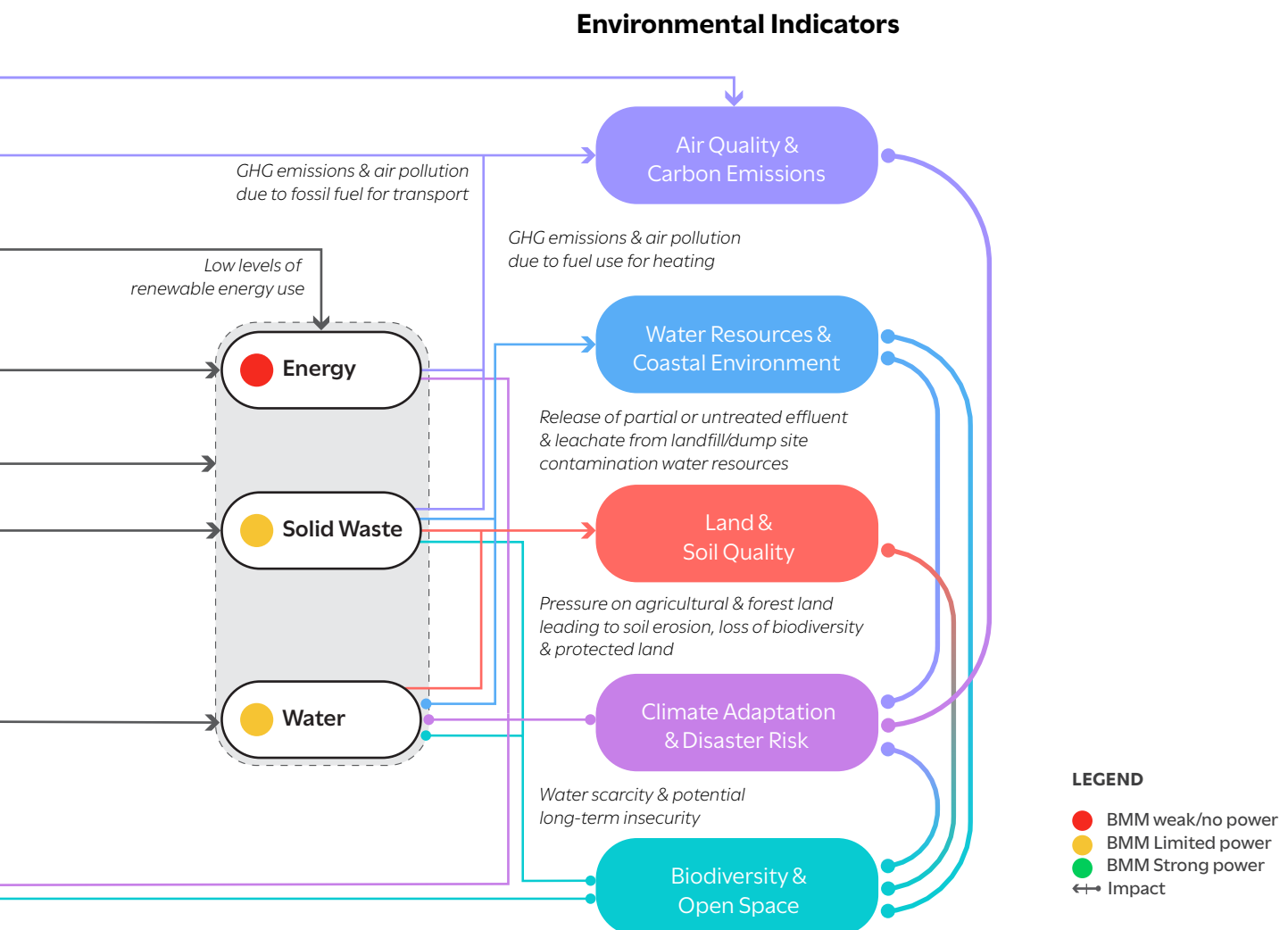
Figure A17: Interlinkages between environmental challenges

Source: AtkinsRéalis analysis, based on technical expertise and stakeholder consultation

- **Rapid population growth** experienced by the City over the past few decades has **led to an increased demand for housing and urban sprawl**, the development of **non-compliant and illegal development, resulting in a loss of agricultural and natural assets** and an **increase in resource demand**.
- Coupled with population growth, **uncontrolled urban growth patterns** have seen the City expand in an east-west direction over a 50km stretch at the foothills of the Uludağ mountains. This sprawling morphology has resulted in a dominance of private vehicle use, despite the presence of metro and tram lines.
- Bursa's significance as a **hub for industrial development** brings economic growth but also places **immense pressure on the local environment; in particular, air and water, and GHG emissions**, due to high resource consumption, including water and electricity, fuel use for industrial processes and competition between different land uses.

At the same time, these **cross-sectoral linkages can enable positive cascading impacts from a few, strategically targeted actions**, as illustrated by the following examples:

- Promoting **mixed-use, transit-oriented developments** around metro and tram stations can enable a **shift away from private vehicle use**, with a consequent **positive impact on air quality and GHG emissions**.
- **Collaborations with industrial groups to implement wastewater treatment initiatives and incentivise low-carbon production** can have a significant impact on water quality and GHG emissions.
- Implementing **enhanced solid waste management processes**, including source segregation and integrated waste management facilities, while also extending the lifetime of the Yenikent landfill, **can help reduce the amount of waste entering the local environment**, helping to improve the quality of soils, surface water resources and biodiversity.



GREEN CITY CHALLENGES FOR BURSA

Challenges in **bold** text prioritised as Green City Challenges by stakeholders in Bursa



LAND USE

- **Loss of agricultural land, natural areas and green space near urban core and industrial areas**
- **Proximity of industrial zones to residential locations with resulting impacts on quality of life and environment**
- **Lack of alignment between plans at different scales**
- **Non-compliant or unauthorised housing developments**
- Unbalanced infrastructure and social amenities between east and west of city
- Lack of an integrated/holistic approach to the conservation of historical buildings



INDUSTRIES

- **Air, water and soil pollution due to industrial activity**
- **High levels of resource consumption (mainly water)**
- **Inadequate organic waste management and recycling**
- Production supply chain vulnerable to external shocks
- Aging industrial infrastructure and building stock
- Lack of regulatory clarity and stakeholder cooperation



BUILDINGS

- **Lack of a detailed digital inventory of existing and planned building stock**
- **Lack of periodic inspections and monitoring of possible physical changes during the life cycle of buildings**
- **Lack of awareness and unsuitable regulations around urban transformation**
- **Large concentration of non-compliant / illegal construction in Osmangazi and Yıldırım districts**
- Insufficient incentives/awareness for retrofitting existing residential buildings
- Outdated zoning plans for the protection of historical and cultural heritage
- Continued dependency on GHG-emitting and polluting energy sources in residential buildings
- Gaps in regulations and infrastructure for building-based energy generation and electric vehicle energy supply



TRANSPORT

- **Lack of lanes dedicated exclusively to public and non-motorised transit (e.g., LRT, bus and bicycle lanes)**
- **Lack of integration across different public transport modes**
- **Lack of integration and information regarding transportation network in rural areas**
- **Large contribution to GHG emissions due to types of fuel and inefficient use of energy**
- Lack of awareness around safety when using micromobility vehicles
- Increasing individual vehicle use
- Lack of carparks and parking lots in the city



WATER

- **Inefficient and high consumption of water resources in the agricultural sector**
- **Insufficient reuse of water from industrial activities (especially the textile sector)**
- **Negative impacts on water resources due to climate change**
- Uncommon use of alternative water sources
- Impact of wastewater treatment on local water and soil quality



SOLID WASTE

- **Difficulties in implementing solid waste legislation by local governments**
- **Insufficient source separation of household and commercial waste**
- **High costs of the solid waste management system (collection, transportation, disposal)**
- **Inadequate coordination between metropolitan and district municipalities**
- Illegal dumping of rubble and bulky wastes (construction and demolition wastes, etc.), especially in rural areas
- Insufficient monitoring, collection and availability of data
- The high impact of inadequate solid waste management practices on the local environment



ENERGY

- **High electricity losses due to low efficiency in residential and industrial buildings, and aging electricity network**
- **Incoherent planning of future infrastructure**
- **Lack of energy efficiency audits in industry**
- Low climate and natural disaster resilience of electricity distribution network in rural areas
- Low levels of renewable energy generation
- Continued use of coal in energy generation
- Continuing use of coal for residential heating
- Lack of regulatory clarity and stakeholder cooperation



CLIMATE & ENVIRONMENT⁵⁴

- **Impact on air, water, and soil quality from industrial activities.**
- **Poor air quality due to fuel use for heating and transport, exacerbated by dense urban development.**
- **Difficulty in monitoring diffuse pollution, climate related hazards, discharge of partially treated wastewater, and certain air pollutants across the Province.**
- **Sea level and sea surface temperature rise as a result of climate change.**
- Poor air quality as a result of mining and construction activities.
- High risk of geophysical hazards due to location of Bursa long fault lines, including earthquakes landslides and tsunami.
- Other climate hazards including, extreme hot days, drought and pluvial flooding, and need to update climate mitigation plan.

55. Challenges across the state topics of air quality, water resource and quality, coastal environments, soil and land quality, biodiversity and open space, climate mitigation and adaptation, have been consolidated to produce a cross-cutting list of priority challenges for the Climate & Environment Sector.

Green City Vision, Strategic Goals, and Targets



Green City Vision

Bursa's Green City Vision sets out the city's aspiration for its future state up to 2050 and provides the basis for a unified and comprehensive approach to sustainable and resilient urban development in the city for the next twenty-five years.

Strategic Goals and Sectoral Targets

Strategic Goals define a medium-term area of focus for each GCAP sector to achieve the Green City Vision, while the **Targets provide a benchmark to monitor progress against the Strategic Goals**. Together, Strategic Goals and Targets anchor the process of identification, prioritisation, and development of actions.

To ensure its grounding within local context and consistency with other urban development initiatives, the Green City Vision has **drawn on the aspirations and ambitions for Bursa's future articulated in other urban development plans** (see Figure A18).

Bursa's Green City Vision was **developed during a Co-creation Workshop with the GCAP Steering Committee**, held on 11 September 2024. After collectively reviewing the Green City Challenges

prioritised for Bursa, GCAP Steering Committee members were invited to **suggest key themes and concepts that could form the basis of Bursa's Green City Vision** (See Figure A19). Draft Vision Statements were then developed collaboratively by Steering Committee members which were then fine-tuned and integrated into a final Green City Vision.



Figure A18: Visions from other urban development plans and strategies in Bursa

Source: AtkinsRéalis analysis



Figure A19: Key words and themes suggested for Green City Vision

Source: Based on inputs at Co-Creation Workshop

In 2050, Bursa is ...

**A resilient, innovative,
liveable and happy
city that implements
sustainability
principles with
common sense
and respects its
historical, cultural and
natural heritage.**

SECTORAL STRATEGIC GOALS AND TARGETS FOR BURSA

The sectoral Strategic Goals and Targets for Bursa's GCAP have been **developed as a bridge between the Green City Vision and Green City Challenges**.

Following the co-creation of the Green City Vision, **two Strategic Goals were defined for each of the eight sectors** – one Goal providing an area of focus for infrastructure investments and the other providing an area of focus for policy and capacity-building initiatives. This approach enables more effective targeting of individual actions within the context of Bursa's multifaceted and interconnected environmental challenges.

In line with the Strategic Goals, **Targets define a quantitative benchmark of performance that each sector is expected to meet in 2035**.

Sectoral Strategic Goals and Targets also form the basis of monitoring, evaluation, and course-correction of actions during and the after the 5-year implementation period of the GCAP.

SECTORAL STRATEGIC GOALS	SECTORAL TARGETS FOR 2035	BASELINE VALUE
 LAND USE		
Protect, develop and make more accessible natural areas, green spaces and social infrastructure.	Per capita green space across each urban district is greater than 15 m².	12m ² in Bursa (2023), N/A at district level
	70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip)	45% (2023)
Deploy an integrated, transparent, and well-enforced sustainable planning system.	Data relevant for planning permissions is publicly available in a digitised/online format for 100% of land parcels.	N/A
	100% of neighbourhoods with a designated UNESCO World Heritage Site have an up-to-date council-approved Master Development Plan.	N/A
 BUILDINGS		
Implement energy efficiency and resilience measures for buildings and urban transformation projects.	Energy efficiency of municipal buildings is increased by 30% compared to 2024.	N/A
	There is no use of coal for household heating.	4-6% (2023)
Improve monitoring of existing and planned building stock for resilience and energy efficiency throughout the building life cycle.	More than 50% of commercial and residential buildings have Energy Performance Certificates.	N/A
 INDUSTRIES		
Reduce environmental pollution from industrial facilities and increase resilience to climate change and economic shocks.	GHG emissions from energy and fuel use in industries are 40% lower than 2014.	5.82 MtCO ₂ e (2020)
	At least 6 OIZs are certified as Green OIZs.	3 (2025)
Promote efficiency and circular economy principles to minimise resource consumption.	The proportion of non-hazardous industrial waste that is reused or recycled is greater than 80%.	N/A



TRANSPORT

• Accelerate the transition to low-emission and sustainable modes of transport.	• Total length of rail system network is 131.5 km.	47.1 km (2023)
	• Total length of the bicycle network is 521 km.	365 km (2023)
	• Low-emission buses comprise 100% of the public bus fleet.	N/A
• Improve integration between different transport modes for urban and rural residents that take into account land use and urban growth patterns.	• Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.	N/A



WATER

• Minimise groundwater, surface water and marine pollution caused by agricultural and industrial activities.	• 100% of the municipal population is served by a wastewater treatment plant	86.8% (2023)
• Increase the sustainability and resilience of water resources to climate change.	• Non-revenue water is each district is lower than 26%	19.5% in urban, 45% in rural districts (2023)
	• Reuse rate of alternative water sources is greater than 15%	N/A



ENERGY

• Accelerate the transition to low-carbon energy sources for heating in all buildings.	• Share of renewable energy use in total energy consumption is greater than 50%.	19.3% (2023)
• Future-proof the electricity generation and distribution network to minimise network losses and improve energy efficiency.	• Number of electricity interruptions are less than 13 per year per customer.	18.6 (2023)



SOLID WASTE

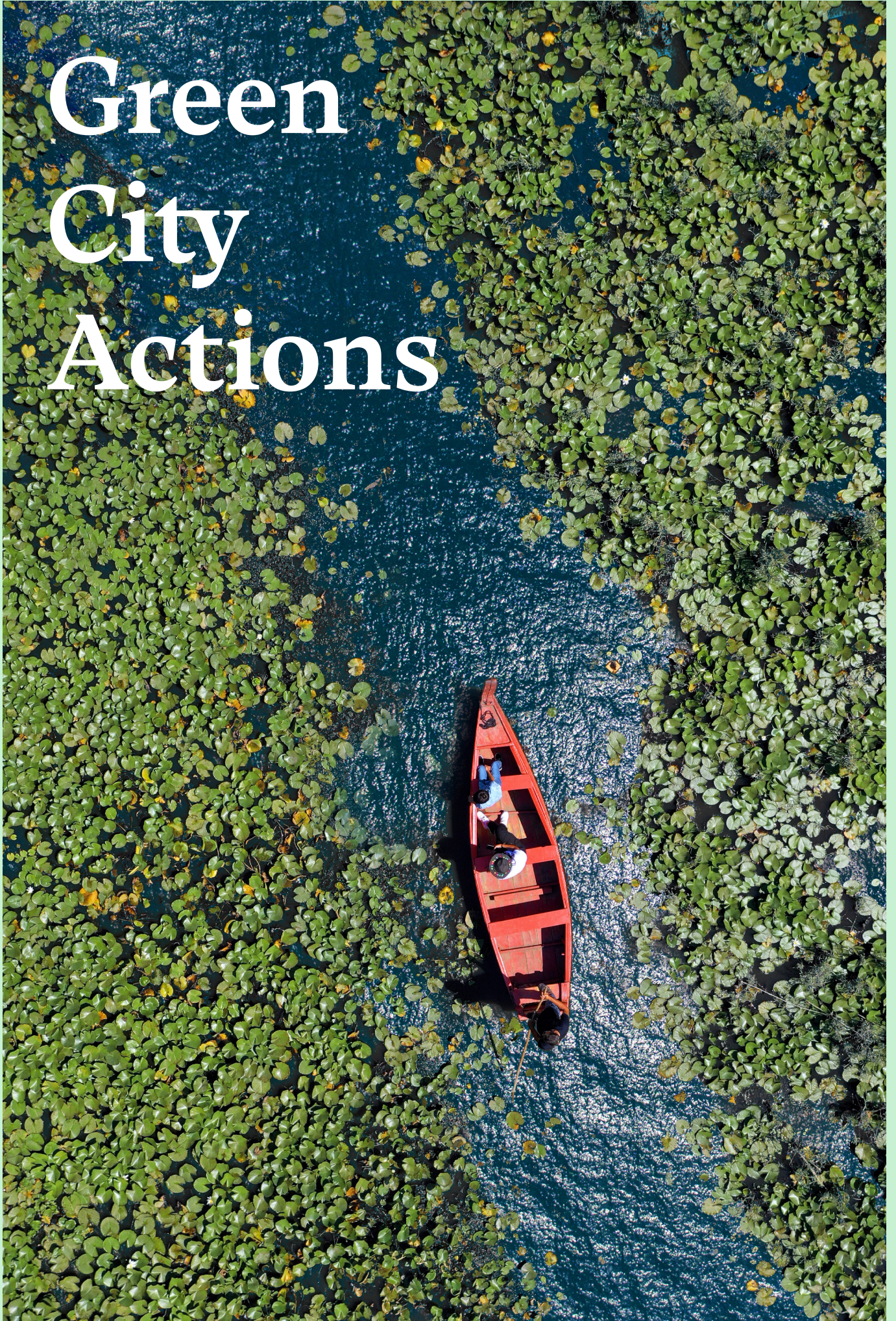
• Ensure appropriate segregation, treatment and disposal of municipal and industrial solid waste.	• Recycling rates in each district is greater than 35%	2% (2023)
	• Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%	24% (2023)
• Improve coordination between different stakeholders for solid waste management.	• Proportion of total waste sent to landfill is less than 65%	98% (2023)



CLIMATE & ENVIRONMENT

• Enhance resilience to the key climate change risks such as extreme heat, drought, flooding, and sea level rise primarily through nature-based solutions.	• Greater than 25% of length of channelised streams are replaced with nature-based solutions for mitigating flood risk	N/A
	• Tree Canopy Cover in each district is greater than 20%	45% (2023) for Bursa, N/A at district level
• Improve monitoring and data collection, sharing and analysis of climate and environment indicators.	• 100% of vehicular and industrial air pollution hotspots are covered by air quality monitoring equipment covering all particulate and gaseous pollutants	N/A
	• 100% of water from municipal WWTPs and industrial areas are covered by water quality monitoring equipment	N/A

Green City Actions



Karacabey Floodplain Forest, Karacabey

Green City Actions are an **integrated, detailed and actionable set of priority infrastructure investments, policy interventions, and capacity-building initiatives** that provide Bursa with a comprehensive implementation roadmap to address its environmental challenges, strengthen its climate resilience, and catalyse sustainable urban development.

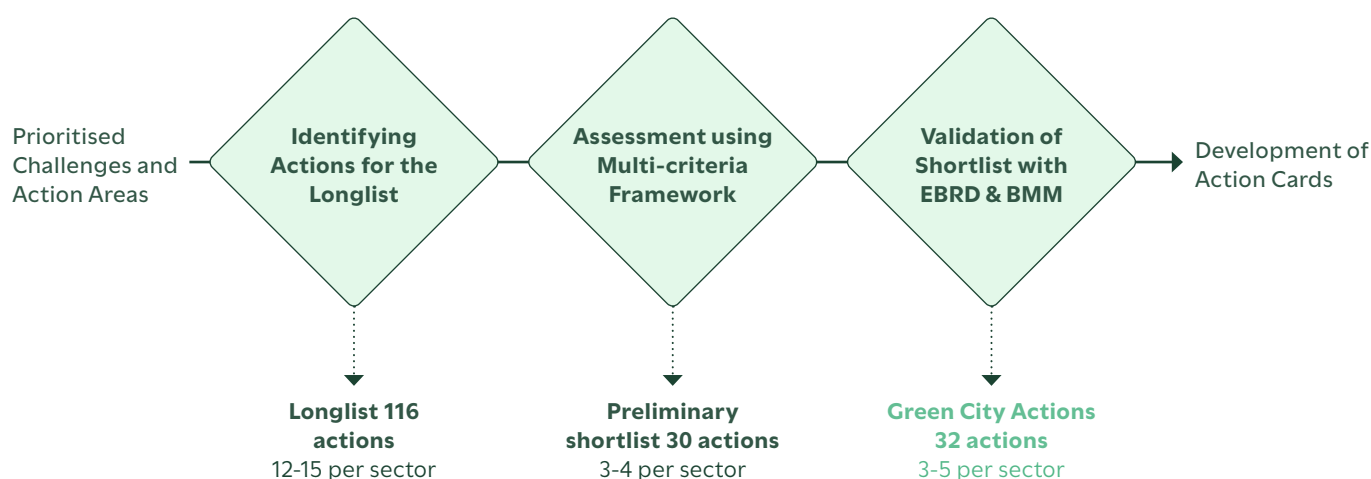


Figure A20: Process of Identifying and Prioritising Green City Actions

Source: AtkinsRéalis analysis, based on EBRD GCAP Methodology

The process of identifying and prioritising Green City Actions is summarised in Figure A20. After the completion of the Baseline Assessment and development of the Green City Vision and sectoral Strategic Goals, **a longlist comprising approximately 12-15 actions for each GCAP sector – 116 actions in total – was developed.** Actions in the longlist were identified on the basis of the Green City Challenges for the sector and the action areas prioritised by Bursa stakeholders during the Baseline Assessment stage.

The longlist was then evaluated by international and local technical experts from the Consultant Team and scored on a scale of 1-3 (1 = low performance, 3 = high performance) against **criteria related to the potential impact and feasibility of implementation** of each action. The evaluation also scored the **potential contribution of each action to sustainability, resilience, gender and economic inclusion, natural capital value, and economic development.** Informed by the scoring, technical experts selected a **preliminary shortlist of 3-5 actions for each sector** that had the highest potential for impact and could begin implementation within the 5-year GCAP implementation period.

The **preliminary shortlist for each sector was validated with technical experts from EBRD** to identify opportunities to enhance impact and improve feasibility, building on their experience with infrastructure investments across EBRD's countries of operation. Based on this discussion, some actions in the longlist were consolidated, and the preliminary shortlist was updated. The fine-tuned and updated list

of actions use **as a basis for the virtual shortlisting meetings with Bursa stakeholders.** These shortlisting meetings were attended more than 60 participants from the public, private, civil society and academic sectors – **including representatives from various BMM departments identified as potential action owners.** Following the virtual shortlisting meetings, **a total of 32 actions across 8 sectors were selected for further development as Green City Actions.**

Technical experts from the Consultant Team then developed each of the 32 Green City Actions, using a bespoke Action Card template to provide **further details on action components, implementation steps and timelines, stakeholders, expected benefits and impacts, costs and financing approaches, and contribution to Sectoral Targets.** This Action Cards were reviewed with potential action owners across BMM departments at in-person Sectoral Meetings to validate details and ensure alignment with other departmental initiatives. This section summarises the key features and expected benefits from implementation of these Green City Actions, and Action Cards containing detailed information are included in Part B of this document.

Actions Summary

Legend

TIMEFRAME

Short (<2 years) Medium (2-5 years) Long (>5 years)

CO-BENEFITS⁵⁵

Direct Indirect No Impact

ACTION OWNER

To be implemented by BMM To be implemented by BMM-affiliated institution

LAND USE

01

Develop a "City Guide"

Develop a comprehensive digital platform integrating various geospatial data relevant to urban planning from all sectors.



2035 TARGETS

- Data relevant for planning permissions is publicly available in a digitised/online format for 100% of land parcels.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS⁵⁶

Dev + Adv N/A
CAPEX €265k
OPEX €50k

IMPACT

Climate Resilience
GHG Emissions
G&EI
Smart
NCV

02

Develop neighbourhood-scale urban transformation strategies

Develop strategies for neighbourhood-wide urban transformation initiatives, aligned with historical context and upper-scale plans.



2035 TARGETS

- Per capita green space across each urban district is greater than 15 m².
- 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip)
- 100% of neighbourhoods with a designated UNESCO World Heritage Site have a council-approved Master Development Plan.
- More than 50% of commercial and residential buildings have Energy Performance Certificates.

TYPE

Strategy / Plan / Study

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €1m
CAPEX N/A
OPEX N/A

IMPACT

Climate Resilience
GHG Emissions
G&EI
Smart
NCV

03

Undertake urban redevelopment along planned metro lines

Implement a transit-oriented urban redevelopment project near a planned metro station.



2035 TARGETS

- Per capita green space across each urban district is greater than 15 m².
- 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip)
- Tree canopy cover in each district is greater than 20%.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv €600k
CAPEX €429.7m
OPEX €235k

IMPACT

Climate Resilience
GHG Emissions
G&EI
Smart
NCV

04

Establish green belts around OIZs

Implement green belts around planned OIZs in Karacabey and Nilüfer Districts to act as buffers for future residential growth.



2035 TARGETS

- Per capita green space across each urban district is greater than 15 m².
- GHG emissions from energy and fuel use in industries are 40% lower than 2014.
- Tree canopy cover in each district is greater than 20%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €250k
CAPEX N/A
OPEX N/A

IMPACT

Climate Resilience
GHG Emissions
G&EI
Smart
NCV

05

Transform existing industrial area in Kestel or Gürsu Districts

Relocate existing industrial facilities away from residential neighbourhoods in Kestel or Gürsu districts and convert the vacated land into green space and social infrastructure.



2035 TARGETS

- Per capita green space across each urban district is greater than 15 m².
- 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip).
- Tree canopy cover in each district is greater than 20%.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv €600k
CAPEX €24m
OPEX €1.05m

IMPACT

Climate Resilience
GHG Emissions
G&EI
Smart
NCV

⁵⁶ 'Direct' = action directly targets positive impacts or co-benefits under the relevant cross-cutting theme, 'Indirect' = action expected to have some indirect positive impacts or co-benefits under the cross-cutting theme, 'None' = no direct or indirect positive impacts or co-benefits expected for the cross-cutting theme

⁵⁷ Dev + Adv = Development and advisory costs; CAPEX = Capital expenses; OPEX = Operating expenses for 5 years after implementation of the Action.



BUILDINGS

06

Develop a digital database for buildings

Establish a centralised digital database to consolidate data on building resilience and energy efficiency.



2035 TARGETS

- More than 50% of commercial and residential buildings have Energy Performance Certificates.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv N/A
CAPEX €1.17m
OPEX €50k

IMPACT

Climate Resilience ☒
GHG Emissions ☐
G&EI ☐
Smart ☒
NCV ☒

07

Enhance structural integrity and energy efficiency in new and existing buildings

Implement enhanced audit regime and incentivise retrofitting of older buildings for compliance with seismic and energy efficiency codes.



2035 TARGETS

- More than 50% of commercial and residential buildings have Energy Performance Certificates.

TYPE

Capacity-building / Awareness Programme

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €3.75m
CAPEX N/A
OPEX N/A

IMPACT

Climate Resilience ☒
GHG Emissions ☐
G&EI ☐
Smart ☒
NCV ☒

08

Implement sustainability and resilience interventions in BMM-owned buildings

Retrofit BMM-owned buildings to improve energy efficiency and serve as Resilience Hubs.



2035 TARGETS

- Energy efficiency of municipal buildings is 30% higher than 2024.
- Tree canopy cover in each district is greater than 20%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €400k
CAPEX €4.15m
OPEX €415k

IMPACT

Climate Resilience ☒
GHG Emissions ☒
G&EI ☒
Smart ☒
NCV ☒

09

Deploy a low-emissions heating programme for residential buildings

Support the installation of low-emissions heating technology in residential buildings to transition away from carbon-intensive heating.



2035 TARGETS

- There is no use of coal for household heating.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €200k
CAPEX €70m
OPEX N/A

IMPACT

Climate Resilience ☒
GHG Emissions ☒
G&EI ☒
Smart ☒
NCV ☐



INDUSTRIES

10

Develop a 'Net Zero Carbon Industries Action Plan'

Explore and develop feasible decarbonisation pathways in industrial facilities across Bursa.

2035 TARGETS

- GHG emissions from energy and fuel use in industries are 40% lower than 2014.
- At least 6 OIZs are certified as Green OIZs.

TYPE

Strategy / Plan / Study

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €1m
CAPEX N/A
OPEX N/A

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

11

Set up a 'Sustainable Industries Help Desk'

Launch a helpdesk to provide technical assistance on modernisation, decarbonisation and increasing resource efficiency of industrial facilities.

2035 TARGETS

- GHG emissions from energy and fuel use in industries are 40% lower than 2014.
- At least 6 OIZs are certified as Green OIZs.
- The proportion of industrial waste that is reused or recycled is greater than 80%.

TYPE

Capacity-building / Awareness Programme

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €50k
CAPEX N/A
OPEX €750k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

12

Develop an industrial waste recycling facility

Study different types of industrial waste produced in Bursa and explore viable pathways for their recycling, reuse, and resale.

2035 TARGETS

- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- GHG emissions from energy and fuel use in industries are 40% lower than 2014.
- The proportion of industrial waste that is reused or recycled is greater than 80%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €500k
CAPEX €10m
OPEX €1.6m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☒
Smart ☐
NCV ☐



TRANSPORT

13

Expand the metro / light rail network

Implement the planned M3 metro line and develop supporting infrastructure to maximise its usage.



2035 TARGETS

- Total length of rail system network is 131.5 km.
- Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv €5m
CAPEX €975m
OPEX €242.9m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

14

Develop micro-mobility infrastructure across Bursa

Implement additional bicycle lanes and supporting infrastructure to enable expansion and safe use of micro-mobility vehicles.



2035 TARGETS

- Total length of the bicycle network is 521 km.
- Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €225k
CAPEX €13.2m
OPEX €264k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

15

Transition to a low-emission bus fleet with supporting infrastructure

Implement a Bus Rapid Transit (BRT) route and supporting infrastructure to facilitate effective and efficient operations of a low-emissions bus fleet.



2035 TARGETS

- Low-emission buses comprise 100% of the public bus fleet.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €525k
CAPEX €80.2m
OPEX €13.3m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☒

16

Enhance operations of the transportation system through smart interventions

Setup an Integrated Traffic Management Centre and expand BursaKart coverage for all public transport modes.



2035 TARGETS

- Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €350k
CAPEX €5.75m
OPEX €550k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☒



WATER

17

Ensure sustainable water use in BMM-owned green spaces

Implement smart irrigation and alternative water systems in all BMM-owned green spaces.



2035 TARGETS

- Reuse rate of alternative water sources is greater than 15%.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €200k
CAPEX €784k
OPEX €39.2k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

18

Implement use of alternative water sources in buildings

Implement systems for rainwater harvesting and reusing alternative water resources in existing and planned municipal and public buildings.



2035 TARGETS

- Reuse rate of alternative water sources is greater than 15%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €330k
CAPEX €1.46m
OPEX €73k

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

19

Ensure sustainable use of water resources in rural districts

Implement measures for reducing non-revenue water and improving efficiency of water use in rural districts.



2035 TARGETS

- Reuse rate of alternative water sources is greater than 15%.
- Non-revenue water is each district is lower than 26%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €550k
CAPEX €36.8m
OPEX €1.1m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐

20

Implement planned upgrades to municipal wastewater treatment plants

Upgrade and complete the penultimate phases of existing WWTPs to enhance capacity, efficiency, and sustainability of wastewater treatment.



2035 TARGETS

- 100% of the municipal population is served by a wastewater treatment plant.
- 100% of water from municipal WWTPs and industrial areas are covered by water quality monitoring equipment.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv €750k
CAPEX €77.23m
OPEX €7.72m

IMPACT

Climate Resilience ☐
GHG Emissions ☐
G&EI ☐
Smart ☐
NCV ☐



ENERGY

21

Increase capacity within the Energy Efficiency Centre

Enhance operations of the existing Energy Efficiency Centre (EEC) to serve as a 'one-stop-shop' for advice on energy efficiency.

2035 TARGETS

- There is no use of coal for household heating.
- More than 50% of commercial and residential buildings have Energy Performance Certificates.
- Number of electricity interruptions are less than 13 per year per customer.

TYPE

Capacity-building / Awareness Programme

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv N/A
CAPEX €100k
OPEX €495k

IMPACT

Climate Resilience
GHG Emissions
G&E
Smart
NCV

22

Establish a heat recovery plant and district heating network

Retrofit the Ovaakça Natural Gas Power Plant to recover heat and develop an accompanying district heating network.



2035 TARGETS

- Share of renewable energy use in total energy consumption is greater than 50%.
- There is no use of coal for household heating.

TYPE

Capacity-building / Awareness Programme

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv €500k
CAPEX €25m
OPEX €2.5m

IMPACT

Climate Resilience
GHG Emissions
G&E
Smart
NCV

23

Expand biogas production capacity

Expand biogas production capacity at the existing Eastern İnegöl Integrated Solid Waste Facility.



2035 TARGETS

- Share of renewable energy use in total energy consumption is greater than 50%.
- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- The proportion of non-hazardous industrial waste that is reused or recycled is greater than 80%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €250k
CAPEX €150m
OPEX €15m

IMPACT

Climate Resilience
GHG Emissions
G&E
Smart
NCV

24

Develop a floating solar farm

Develop a floating solar farm and assess feasibility of battery storage and similar renewable energy facilities.



2035 TARGETS

- Share of renewable energy use in total energy consumption is greater than 50%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €900k
CAPEX €7.6m
OPEX €760k

IMPACT

Climate Resilience
GHG Emissions
G&E
Smart
NCV



SOLID WASTE

25

Improve performance through digital and governance initiatives

Implement joined-up digital and governance initiatives to improve coordination, sustainability, and efficiency in solid waste management.



2035 TARGETS

- Proportion of total waste sent to landfill is less than 65%.

TYPE

Data / Monitoring System

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €50k
CAPEX €115k
OPEX €195k

IMPACT

Climate Resilience
GHG Emissions
G&E
Smart
NCV

26

Improve waste segregation across the city

Facilitate the effective implementation of waste segregation programmes for all buildings and at strategic public open spaces.



2035 TARGETS

- Recycling rates in each district is greater than 35%.
- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- Proportion of total waste sent to landfill is less than 65%.

TYPE

Capital Investment (Project)

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv €225k
CAPEX €9.87m
OPEX €2.47m

IMPACT

Climate Resilience
GHG Emissions
G&E
Smart
NCV

27

Enhance capacity and efficiency of waste transfer station network

Build out planned waste transfer stations and carry out efficiency enhancements for existing transfer stations.



2035 TARGETS

- Recycling rates in each district is greater than 35%.
- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- Proportion of total waste sent to landfill is less than 65%.

TYPE

Capital Investment (Project)

TIMEFRAME

Medium

ESTIMATED COSTS

Dev + Adv €400k
CAPEX €1.47m
OPEX €2.17m

IMPACT

Climate Resilience
GHG Emissions
G&E
Smart
NCV

28

Implement the Western Regional Integrated Solid Waste Disposal Facility

Implement the planned Western Regional Integrated Solid Waste Disposal Facility and develop a transition plan for the existing Yenikent Solid Waste Landfill.



2035 TARGETS

- Recycling rates in each district is greater than 35%.
- Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.
- Proportion of total waste sent to landfill is less than 65%.

TYPE

Capital Investment (Project)

TIMEFRAME

Long

ESTIMATED COSTS

Dev + Adv €600k
CAPEX €200.6m
OPEX €54.35m

IMPACT

Climate Resilience
GHG Emissions
G&E
Smart
NCV



CLIMATE & ENVIRONMENT

29



Develop a digital dashboard for air, noise, water and soil quality monitoring

Develop a digital dashboard to enhance monitoring, data sharing, and reporting of air, water, noise and soil quality pollution.

2035 TARGETS

- 100% of vehicular and industrial air pollution hotspots are covered by air quality monitoring equipment covering all particulate and gaseous pollutants.
- 100% of water from municipal WWTPs and industrial areas are covered by water quality monitoring equipment.

TYPE

Data /
Monitoring
System

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	€50k
CAPEX	€355k
OPEX	€175k

IMPACT

Climate Resilience	
GHG Emissions	
G&EI	
Smart	
NCV	

30



Develop a 'River Depollution Roadmap' for the Nilüfer Stream

Develop a roadmap to address water pollution and reduce impacts of urban development on Nilüfer Stream.

2035 TARGETS

- 100% of the municipal population is served by a wastewater treatment plant.
- Greater than 25% of length of channelised streams are replaced with nature-based solutions for mitigating flood risk.
- Tree canopy cover in each district is greater than 20%.

TYPE

Strategy / Plan /
Study

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	€300k
CAPEX	N/A
OPEX	N/A

IMPACT

Climate Resilience	
GHG Emissions	
G&EI	
Smart	
NCV	

31



Develop a Heat Action Plan

Develop a roadmap to address water pollution and reduce impacts of urban development on Nilüfer Stream.

2035 TARGETS

- Per capita green space across each urban district is greater than 15 m².
- Tree canopy cover in each district is greater than 20%.

TYPE

Strategy / Plan /
Study

TIMEFRAME

Short

ESTIMATED COSTS

Dev + Adv	€300k
CAPEX	N/A
OPEX	N/A

IMPACT

Climate Resilience	
GHG Emissions	
G&EI	
Smart	
NCV	

32



Implement Nature-Based Solutions along urban rivers

Implement a pilot project that utilises nature-based solutions to address flood risk along urban rivers and locate additional opportunities for similar interventions.

2035 TARGETS

- Per capita green space across each urban district is greater than 15 m².
- 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip)
- 100% of the municipal population is served by a wastewater treatment plant.
- Greater than 25% of length of channelised streams are replaced with nature-based solutions for mitigating flood risk.
- Tree canopy cover in each district is greater than 20%.

TYPE

Capital
Investment
(Project)

TIMEFRAME

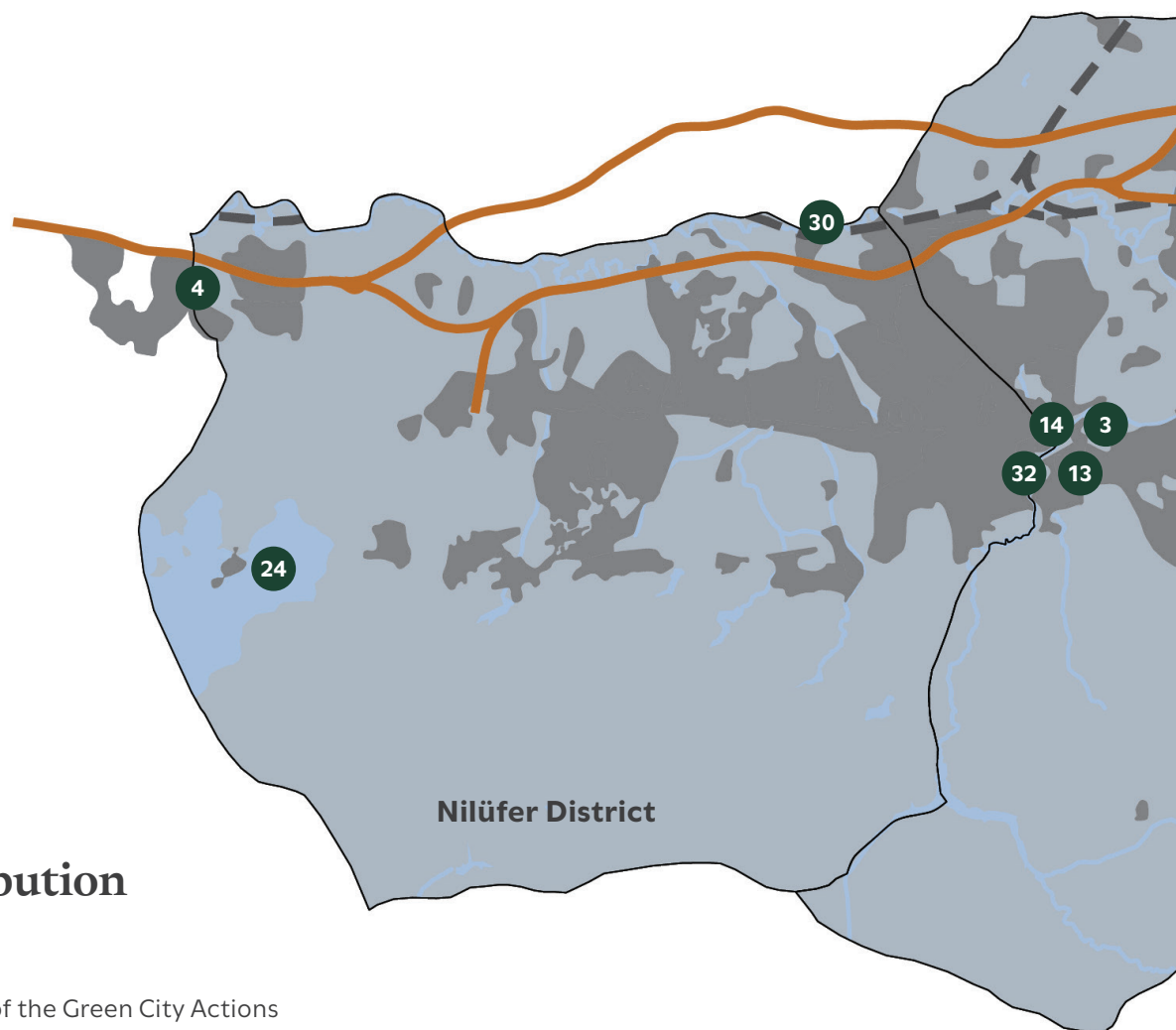
Medium

ESTIMATED COSTS

Dev + Adv	€700k
CAPEX	€3.21m
OPEX	€321k

IMPACT

Climate Resilience	
GHG Emissions	
G&EI	
Smart	
NCV	



Spatial Distribution of Actions

The geographic spread of the Green City Actions is shown in Figure A21. Actions are **strategically distributed across Bursa, combining city-wide initiatives with targeted interventions** in specific urban and rural districts to respond to local needs and existing opportunities. While many actions, such as those related to buildings, apply across the city, others are tailored to local context, including rural water management and district-specific infrastructure projects. This **spatially integrated approach ensures that the GCAP addresses the diverse needs of Bursa's geography and population.**

LEGEND

- | | | |
|--------------|-------------------------|----------------------------------|
| Water bodies | Urban Areas | Action location known |
| Rivers | Bursa Province Boundary | Action location to be determined |
| Highways | Rural Districts | |
| Railways | Urban Districts | |

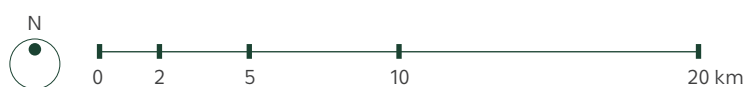
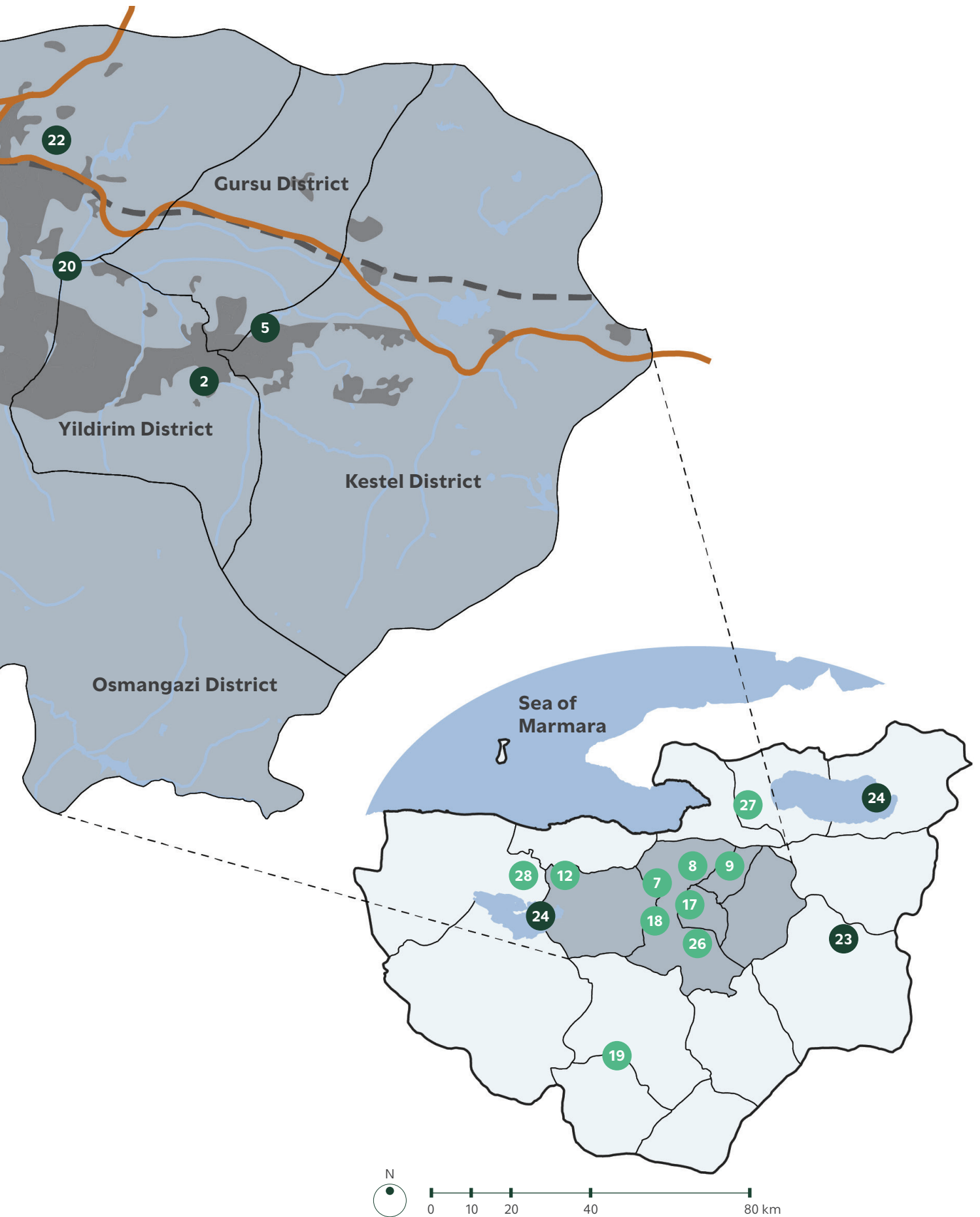


Figure A21: Map of proposed Green City Actions

Source: AtkinsRéalis analysis



Estimates of Investment Needs and Finance Sources

It is estimated that **EUR 20.6 million⁵⁷ (TRY 925 million)** are required for development and advisory support for Bursa's GCAP Green City Actions. **Capital expenditures (CAPEX) are estimated at EUR 2.13 billion (TRY 95.7 billion), and operational expenditures (OPEX) over the first 5 years are estimated at EUR 348.6 million (TRY 12.7 billion).** As shown in Table A21 and Figure A22:

- Green City Actions in the **Transport sector account for the highest costs associated with development and advisory support, and capital and operational expenditures**, mainly due to the high costs associated with delivering a new Metro Line across the City.
- Actions in the **Buildings sector account for high advisory costs** associated with implementing policy and monitoring actions, and **relatively low capital and operational expenditures** related to surgical interventions for sustainability, resilience, and energy efficiency in new and existing buildings.
- The **Land Use sector is estimated to incur relatively high capital expenditures**, due to the significant planning and design costs and investment required for implementation of urban regeneration projects.
- Similarly, the **Solid Waste sector is estimated as having relatively high capital and operational expenditures** due to the number of actions related to implementation of large infrastructure projects.

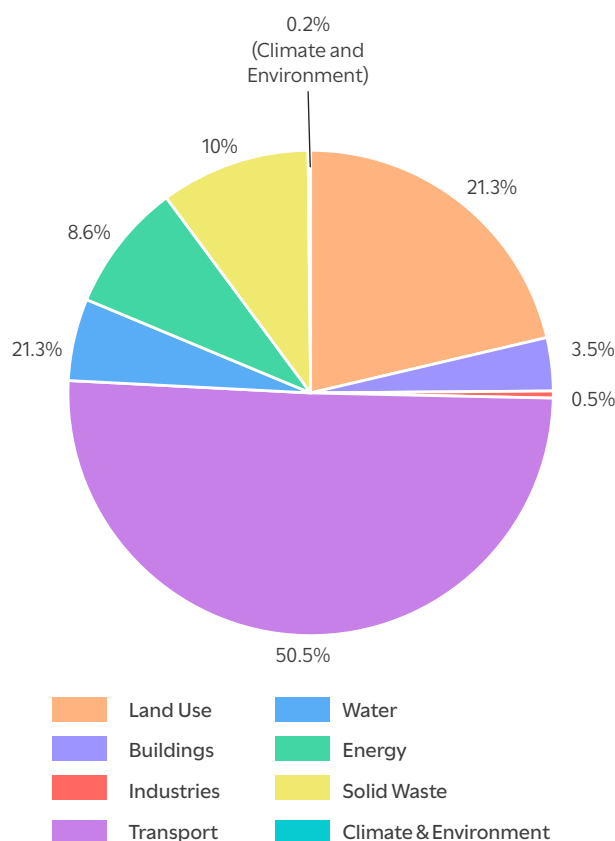


Figure A22: Summary of estimated sectoral capital expenditures for Green City Actions

Source: AtkinsRéalis analysis

58. Exchange rate at time of writing (June 2025) was approximately EUR 1 = TRY 45

Sector	Estimated Costs (EUR million)			Estimated Costs (TRY million)		
	Development / Advisory	CAPEX	OPEX over 5 years	Development / Advisory	CAPEX	OPEX over 5 years
LAND USE	2.45	453.97	1.34	110.25	20,428.43	60.08
BUILDINGS	4.35	75.32	0.47	195.75	3,389.18	20.93
INDUSTRIES	1.55	10.00	2.35	69.75	450.00	105.75
TRANSPORT	6.1	1,074.15	257.01	274.50	48,361.75	11,535.13
WATER	1.83	116.35	8.94	82.35	5,236.49	401.80
ENERGY	1.65	182.70	18.76	74.25	8,231.50	848.96
SOLID WASTE	1.28	212.06	59.19	57.38	9,478.14	2,663.19
CLIMATE & ENVIRONMENT	1.35	3.57	0.50	60.75	160.43	22.32
TOTAL	20.56	2,128.12	348.56	924.98	95,735.92	15,658.26

Table A21: Summary of estimated sectoral costs for Green City Actions

Source: AtkinsRéalis analysis

Contribution to GHG Emissions Reduction

Due to limited data availability and detail for actions, GHG emissions reductions were quantified for only 11 of the 32 Green City Actions, within the Buildings (2 out of 4 actions), Transport (3 / 4), Energy (3 / 4), and Water (2 / 4) sectors. Nevertheless, **the GHG emissions reductions from these 11 Actions (shown in Table A22, with detailed methodology and calculations included in Appendix B) are estimated at 663,020 tCO₂e per annum – assuming they are implemented in full.** GHG emissions reductions from these 11 Green City Actions **are equivalent to 3.5% of total GHG emissions in Bursa as of 2023.**

The GCAP represents an important opportunity for Bursa to catalyse the **decarbonisation of its infrastructure and urban systems in line with its ambition to reduce emissions by 40% compared to the baseline year of 2014** -- i.e. GHG emissions need to reduce by about 1.9 tonnes CO₂e per person per year, from 4.74 tonnes CO₂e per person per year in 2014 to 2.84 tonnes CO₂e per person per year in 2030. Considering Bursa's projected population for 2030 is 3.43 million, GHG emissions

reductions from GCAP Actions equate to around 0.19 tCO₂e per person per year, **or roughly 10% of the total emissions reduction required to achieve the 2030 target.**

As other Green City Actions are further detailed and data for quantification becomes available, the **actual GHG emissions reductions from implementation of the GCAP is expected to be far higher.** Additionally, scaling up several Green City Actions – particularly in the Buildings sector – could result in additional GHG emissions reductions.

It should be noted that **the GHG emissions savings as a result of implementing the Green City Actions have not taken into account the embodied carbon associated with the construction, management and operation.** Measures to reduce embodied carbon should therefore be considered when developing each action in detail, which could include using low-carbon and sustainable materials, embedding operational efficiency and developing an end-of-life plan.

ID	Action Title	Carbon saving per annum (tCO ₂ e)
Buildings		
8	Implement sustainability and resilience interventions in BMM-owned buildings.	31,100
9	Deploy a low-emissions heating programme for residential buildings	216,200
Transport		
13	Expand the metro / light rail network	190,770
14	Develop micro-mobility infrastructure across Bursa	43,000
15	Transition to a low-emission bus fleet with supporting infrastructure	7,000
Water		
19	Ensure sustainable use of water resources in rural districts	1,750
20	Implement planned upgrades to municipal wastewater treatment plants	88,000
Energy		
22	Establish a heat recovery plant and district heating network	32,300
23	Expand biogas production capacity	4,200
24	Develop a floating solar farm	13,700
Solid Waste		
28	Implement the Western Regional Integrated Solid Waste Disposal Facility	35,000
TOTAL		663,020

Table A22: Estimated GHG Emissions Reductions from Selected Green City Actions

Source: AtkinsRéalis analysis

Enhancement of Natural Capital Value

As discussed in previous sections, the process for development of Green City Actions used EBRD's Natural Capital Valuation (NCV) Approach. The final step of this NCV Approach estimated **the potential impact of implementation of individual Green City Actions on the natural capital value** in Bursa. These estimates rely on a number of significant assumptions given the early stage of action design and the novel approach used and so come with a substantial amount of uncertainty. They should be updated as the actions are refined further. They are also likely an underestimate as not every possible ecosystem service that could be impacted by these actions was able to be valued. A more detailed methodology for the estimation is provided in Appendix C.

Using EBRD's NCV approach, **14 Actions were identified as having a direct, positive impact on Bursa's Natural Capital Value** and were selected for a quantitative estimation of NCV impacts. Two different approaches to quantitative estimation were followed:

- **'Bottom-up' approach: For 6 Actions with significant nature-related components and thus expected to have the largest impact on NCV**, a more detailed, 'bottom-up' approach to estimation of value was followed. For these nature-focused Actions, an estimated value of impact on each ecosystem service was first calculated. These estimates of impact on individual ecosystem services were then aggregated to derive a total value.

ID	Action Title	Net Annual NCV Impact	Net Present Value NCV Impact
Land Use		€ 8,641,313	€ 136,203,174
2	Develop neighbourhood-scale urban transformation strategies	€ 2,319,326	€ 36,556,891
3	⊙ Undertake urban redevelopment along planned Metro lines	€ 2,319,326	€ 36,556,891
4	⊙ Establish green belts around OIZs	€ 2,943,125	€ 46,389,121
5	⊙ Transform existing industrial area in Kestel or Gürsu Districts	€ 1,059,537	€ 16,700,270
Buildings		€ 70,636	€ 1,113,351
8	⊙ Implement sustainability and resilience interventions in BMM-owned buildings	€ 70,636	€ 1,113,351
Transport		€ 5,956,233	€ 93,881,316
13	Expand the metro / light rail network	€ 2,978,117	€ 46,940,658
14	Develop micro-mobility infrastructure across Bursa	€ 2,978,117	€ 46,940,658
Water		€ 6,940,585	€ 109,396,530
17	Ensure sustainable water use in green spaces	€ 694,058	€ 10,939,653
18	Implement use of alternative water sources in buildings	€ 694,058	€ 10,939,653
19	Ensure sustainable use of water resources in rural districts	€ 2,082,175	€ 32,818,959
20	Implement planned upgrades to municipal wastewater treatment plants	€ 3,470,292	€ 54,698,265
Energy		€ 3,772,307	€ 59,458,581
24	Develop a floating solar farm	€ 3,772,307	€ 59,458,581
Climate & Environment		€ 9,064,607	€ 142,875,080
30	⊙ Develop a 'River Depollution Roadmap' for the Nilüfer Stream	€ 8,077,548	€ 127,317,187
32	⊙ Implement Nature-based Solutions along urban rivers	€ 987,059	€ 15,557,892
TOTAL		€ 34,445,682	€ 542,928,032
⊙ NCV impacts estimated using a 'bottom-up' approach			

Table A23: Estimated contributions to Natural Capital Value from selected Green City Actions

Source: AtkinsRéalis analysis

- **‘Top-down’ approach: For the other 8 actions, a ‘top-down’, judgement-based approach to estimation of NCV impacts was followed.** Sectoral estimates of total NCV impact were derived using EBRD’s NCV Approach. These sectoral estimates were then validated using the Action-level estimates derived through a ‘bottom-up’ approach. Finally, sectoral estimates were apportioned among the Actions within that sector, using expert judgement.

Further details on these two methodologies to estimate NCV impacts are provided in Appendix C2.

Table A23 shows the estimated NCV contributions from the 14 actions identified as having a direct impact on NCV. Implementing all of these actions is estimated to result in **an increase of €34.45 million in Bursa’s annual natural capital value** or a total value of €543 million in present-value terms (estimated using a 50-year assessment period and a 6% discount rate). Using a sectoral lens, NCV impacts can be summarised as follows:

- Actions in the **Climate & Environment and Land Use sectors would result in the highest proportion of NCV increase**, as a result of an increase in urban green spaces cover in highly urbanised/industrial areas and the introduction of NbS along urban rivers and rural streams.
- The **Water and Transport Sectors follow closely**, accounting for the next biggest increases in NCV as a result of expected water pollution and GHG emission reductions due to the promotion of non-motorised transport options across the City and through increased and more accessible urban green spaces to improve recreation and wellbeing.
- Although the actions in the **Solid Waste and Industries** sector will result in improved solid waste management practices across the City and potentially the reduced impact of industrial activities on the local environment, they are not expected to have an impact on NCV.

Figure A23 shows the impact of the 6 Actions with significant nature-related components (i.e. those Actions where NCV was quantified using a ‘bottom-up’ approach) on **the value of different ecosystem services in Bursa**.

- The 6 nature-focused Actions are expected to increase the value of **global climate regulation, recreation, flood regulation, and water quality** ecosystem services. The total **increase in value of these ecosystem services is estimated at €26.7 million**.
- As shown in Figure A23, **the largest increases in NCV are for the global climate regulation and recreation** ecosystem services, in the order of around €12.5 million each. These increases are largely attributable to Actions related to river revitalisation (#30 and #32) and establishing green belts around OIZs (#4).
- Similarly, the annual NCV increase for the **flood regulation ecosystem service** is estimated at €1.43 million, largely driven by the Action to develop a river depollution roadmap for Nilüfer Stream (#30).
- Additionally, these actions help conserve a baseline natural capital value of €11.21 million for the **crop provisioning** ecosystem service. This is driven by measures to protect existing croplands as part of the River Depollution Roadmap (Action #30) and establishing a green buffer around OIZs (#4).

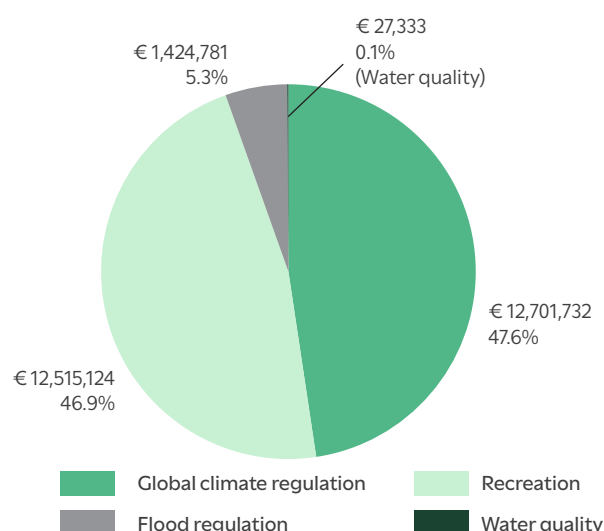


Figure A23: Annual increase in NCV for ecosystem services
Source: AtkinsRéalis analysis

Employment and Job Creation

Green City Actions are estimated to generate **around 2,300** new employment opportunities across multiple sectors. These opportunities arise from the **construction, operation, and maintenance phases of infrastructure projects**, as well as the **delivery of green economy services and capacity-building initiatives**.

Green City Actions will also **contribute to inclusive economic growth by creating diverse and accessible employment pathways**. They offer opportunities for **upskilling and the formalisation of employment, particularly benefiting women, people with disabilities, and young people**, thereby supporting long-term local economic development. To further enhance benefits from Green City Actions, their implementation should be supported with policies that support women's employment and retention in the male dominated construction sector, including when procuring and contractor or work as part of the Actions. A summary of employment opportunities expected through Green City Actions in various sectors is as follows:

- Job creation opportunities are **particularly prominent in sectors such as Transport, Energy, Water, and Solid Waste**, where large-scale infrastructure investments and service upgrades are planned.
- In the **Transport** sector, the expansion of the metro network alone is **expected to create up to 1,000 jobs during the construction phase**, while the transition to a low-emission bus fleet, development of a BRT system, and implementation of smart transport solutions will **generate additional employment in vehicle operation, traffic management, and digital services**. Similarly, the development of a city-wide micro-mobility network will support new business opportunities and jobs related to infrastructure installation, maintenance and the safety awareness campaigns.
- The **Energy and Water** sectors both present significant employment potential. The **construction and operation of a district heating network** in Osmangazi, the **expansion of biogas production capacity** in İnegöl, and the **upgrading of wastewater treatment plants** create **local employment opportunities in engineering, construction, and system maintenance**.
- **Solid waste** management actions are projected to create **over 190 jobs across various initiatives**, including the operation of new waste transfer stations, an integrated waste management facility, and a city-wide waste segregation programme.
- Actions across the **Land Use, Buildings, Industries, and Climate & Environment sectors are distributed across the city**, will generate opportunities for employment in planning, construction, retrofitting, and environmental monitoring.

Gender and Economic Inclusion

Green City Actions are expected to **contribute to job creation, improved access to services, and targeted support for underserved and vulnerable groups, including women, youth, the elderly, and people with disabilities.**

- In the **Land Use** and **Buildings** sectors, urban regeneration, retrofitting, and the transformation of industrial areas into green and social spaces **directly enhance access to safe, inclusive public environments and create employment opportunities in planning, construction and maintenance.**
- **Transit-oriented development and expansion of public transport infrastructure improve equitable access to jobs, education, and services**, particularly benefiting the low-income and underserved communities. In addition, the emphasis on **digital tools and databases offers opportunities for awareness-raising and digital skills training tailored to underserved groups.**
- In sectors such as **Energy, Water, and Solid Waste**, Green City Actions often **support economic inclusion through reducing utility costs, improving service delivery, and enhancing the quality of residential neighbourhoods.** Energy efficiency measures and district heating networks can **lower household energy bills and improve indoor comfort**, especially for low-income and energy-poor households.
- **Water**-related actions improve **agricultural productivity and food security in rural areas**, while also generating **employment in infrastructure development and maintenance.**
- **Solid waste** management upgrades offer **formal employment opportunities for informal workers**, many of whom are women or migrants, and provide an opportunity for safer and more equitable working conditions.
- Actions in the **Climate & Environment** sector, particularly those targeting monitoring of environmental indicators, are designed to **improve identification and addressal of environmental risks that disproportionately affect vulnerable populations**, supporting more targeted and inclusive resilience planning.

Implementation Roadmap

Figure A24 provides an **indicative implementation programme** for the Bursa GCAP actions. Timelines for implementation across Green City Actions have been developed to **maximise complementarity, optimise stakeholder engagement, and ensure efficient deployment of resources within BMM.** To provide a visible demonstration of progress, each sector includes at least **a few 'quick win' actions that can be implemented within two years** after GCAP adoption. These 'quick win' actions also provide an **opportunity to set up and test suitable implementation approaches within the sector**, lessons from which can be applied to enable a smoother implementation process for more complex, longer-term actions.

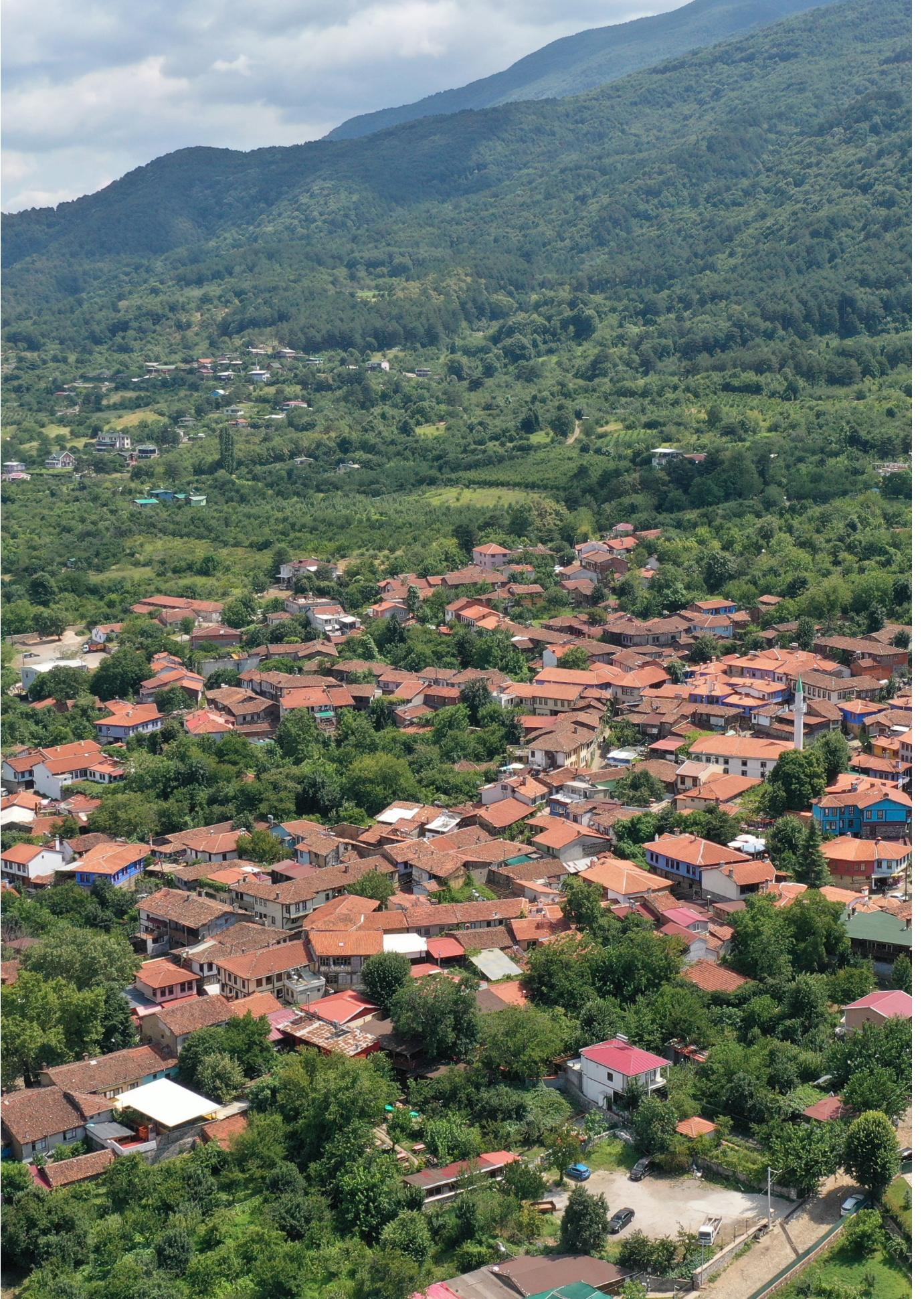
ID	Action Title	2026	2027	2028	2029	2030	2031	2032+
Land Use								
1	Develop a "City Guide"							
2	Develop neighbourhood-scale urban transformation strategies							
3	Undertake urban redevelopment along planned metro lines							
4	Establish green belts around OIZs							
5	Transform existing industrial area in Kestel or Gürsu Districts							
Buildings								
6	Develop a digital database for buildings							
7	Enhance structural integrity and energy efficiency in new and existing buildings							
8	Implement sustainability and resilience interventions in BMM-owned buildings							
9	Deploy a low-emissions heating programme for residential buildings							
Industries								
10	Develop a 'Net Zero Carbon Industries Action Plan'							
11	Set up a 'Sustainable Industries Help Desk'							
12	Develop an industrial waste recycling facility							
Transport								
13	Expand the metro / light rail network							
14	Develop micro-mobility infrastructure across Bursa							
15	Transition to a low-emission bus fleet with supporting infrastructure							
16	Enhance operations of the transportation system through smart interventions							
Water								
17	Ensure sustainable water use in BMM-owned green spaces							
18	Implement use of alternative water sources in buildings							
19	Ensure sustainable use of water resources in rural districts							
20	Implement planned upgrades to municipal wastewater treatment plants							
Energy								
21	Increase capacity within the Energy Efficiency Centre							
22	Establish a heat recovery plant and district heating network							
23	Expand biogas production capacity							
24	Develop a floating solar farm							
Solid Waste								
25	Improve performance through digital and governance initiatives							
26	Implement a waste segregation programme across the city							
27	Enhance capacity and efficiency of waste transfer station network							
28	Implement the Western Regional Integrated Solid Waste Disposal Facility							
Climate & Environment								
29	Develop a digital dashboard for air, noise, water and soil quality monitoring							
30	Develop a 'River Depollution Roadmap' for the Nilüfer Stream							
31	Develop a Heat Action Plan							
32	Implement Nature-Based Solutions along urban rivers							

LEGEND

Intervention planning and development Implementation

Figure A24: Roadmap for implementation of Green City Actions

Source: AtkinsRéalis analysis



Panorama of Cumalıkızık Village, Yildirim

Implementation and Monitoring

The Implementation and Monitoring Plan outlines a robust and collaborative **governance** approach to implement Green City Actions, monitor progress and impact, and **improve outcomes from Actions** to maximise their benefits to Bursa's residents.

The Implementation and Monitoring (I&M) plan supports the effective implementation of the Bursa GCAP and track its process and impact going forward.

The approach outlined below will **ensure that BMM has an effective structure** to:

- **Support and track the implementation** of its GCAP;
- **Review and report the results and impacts** of each Green City Action; and
- **Identify opportunities for amendments or enhancements** of Green City Actions during the implementation of the GCAP.

A set of tools have been **developed to support BMM in its monitoring activities**, including:

- **The 'Progress Monitoring Plan' (PMP)** – to aid with monitoring GCAP implementation progress; and
- **The 'Impact Monitoring Plan' (IMP)** – to aid with monitoring the impact of Green City Actions.

These tools will allow BMM to regularly review its performance, promote transparency and facilitate continuous improvement of both the Green City Actions and their corresponding implementation structures.

This chapter also outlines key roles and responsibilities necessary to implement the Bursa GCAP and maintain accountability during its implementation process.

Implementation Approach and Governance

A clear and well-structured governance framework is critical for the effective implementation of the Bursa GCAP and its Green City Actions. As outlined in Table A25 and illustrated in Figure A25, this framework is formed of a set of critical roles with distinct responsibilities created to drive a coordinated and holistic implementation effort.

This governance framework is formed of the **GCAP Implementation Steering Committee**, which will provide strategic oversight on the implementation of Green City Actions, help resolve barriers and approve annual monitoring reports. The **GCAP Coordinator**, ideally from the BMM Department for Environmental Protection and Control, will take leadership in driving the implementation of the GCAP and coordinate monitoring efforts by collecting data from the **GCAP Delivery Team**, reporting back to the GCAP Implementation Steering Committee and creating Annual Monitoring Reports. The GCAP Delivery Team, formed of representatives from Green City Action Implementation Agencies, will be responsible for coordinating action implementation efforts within their agency, collecting relevant data and feeding this back to the GCAP coordinator. Finally, the **Green City Champions**, representatives from departments and external stakeholders, will help to advocate for the GCAP and build political and public support for its implementation.

A **Terms of Reference** for each of the roles should be developed to define the unit's structure, responsibilities, and decision-making processes, ensuring clarity and consistency in its operations.

REPORTING

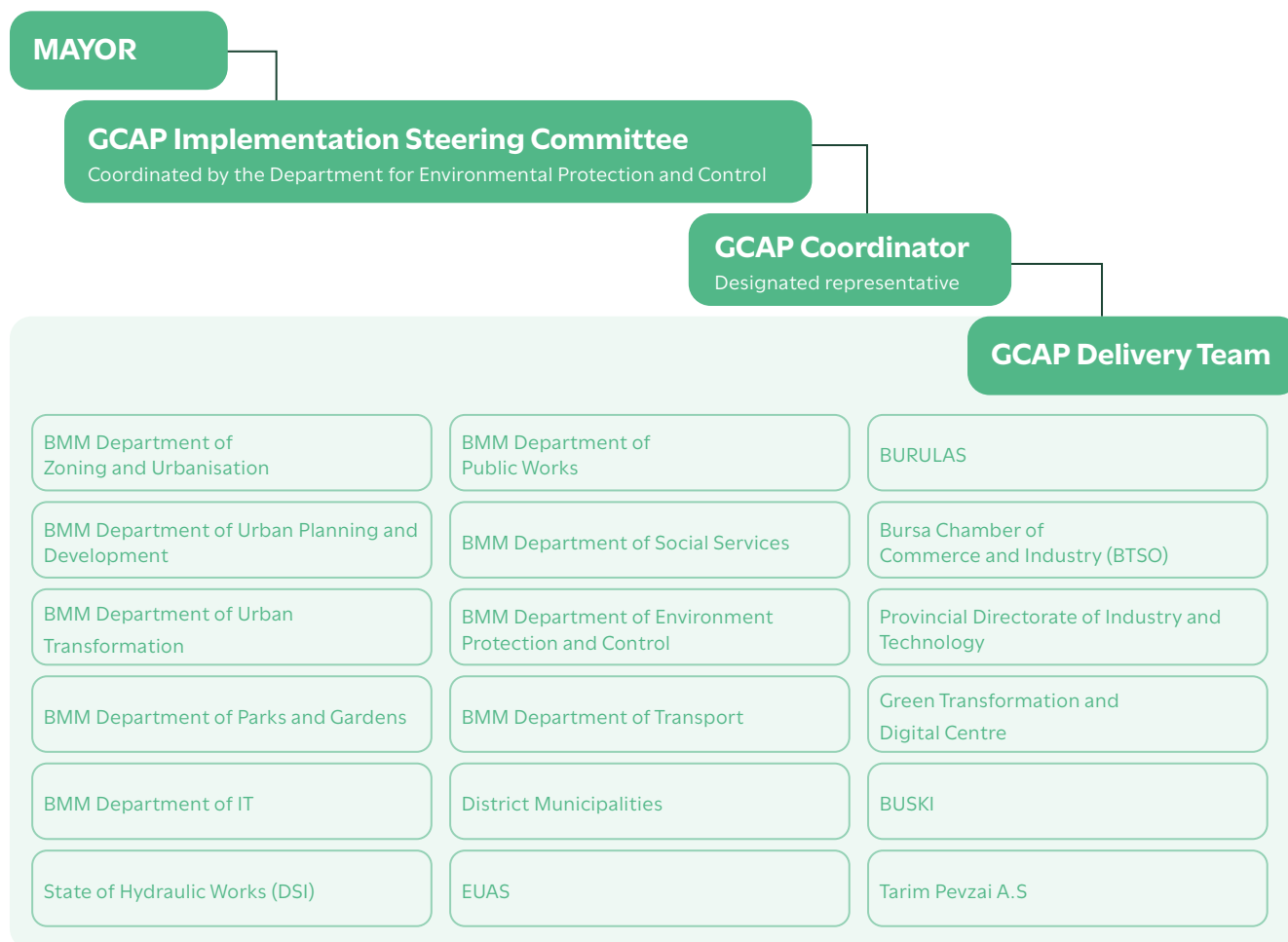
Each year, the GCAP coordinator should produce an **Annual Monitoring Report** to capture the status of implementation, highlight any barriers and potential solutions, as well as propose any relevant updates to the Green City Actions to aid with their implementation. This should be a public-facing report to maintain transparency regarding the progress of the GCAP implementation with stakeholders and the public, subject to approval by the GCAP Implementation Steering Committee.

I&M Role	Description of I&M Role	Their key responsibilities
GCAP IMPLEMENTATION STEERING COMMITTEE	The GCAP Implementation Steering Committee will play a key role in overseeing the delivery of Green City Actions. It should serve as a unit to provide strategic direction, resolve implementation barriers and ensure the Actions are implemented in alignment with the Green City Agenda as well as broader sustainable development goals in Bursa. If possible, this committee should mirror the structure and function of the original GCAP Steering Committee to maintain continuity. The committee should meet on a quarterly basis to maintain momentum through the implementation process.	• Liaise with the GCAP Coordinator to obtain regular updates on GCAP implementation processes. • Offer guidance and support to resolve any barriers hindering the implementation of Green City Actions. • Provide strategic direction during the implementation process. • Oversee monitoring activities as part of the PMP and IMP and approve any annual monitoring plans.
GCAP COORDINATOR	The GCAP Coordinator should hold a leadership role with the authority to drive the implementation of the GCAP and ensure accountability across departments. The Coordinator is a critical figure in facilitating the implementation and monitoring process. The role should be held by a single representative, ideally from the BMM Department for Environmental Protection and Control, or someone who has been close to the GCAP development process and is familiar with its contents.	• Act as the primary focal point for all GCAP-related activities. • Work closely and collaborate with both the GCAP Implementation Steering Committee and the GCAP Delivery Team. • Obtain relevant data for the PMP and IMP by liaising with the GCAP Delivery Team. • Populate the PMP and IMP and produce any necessary reports, in a timely manner, for presentation to the GCAP Implementation Steering Committee. • Interact with Green City Champions to gather feedback and stakeholder input on the implementation of Green City Actions.
GCAP DELIVERY TEAM	The GCAP Delivery Team should consist of representatives from relevant departments and organisations who have been designated as an Implementation Agency as part of the Green City Actions. They should work closely with the GCAP Coordinator to ensure the Actions are implemented in an effective manner and align with the Green City Vision, Strategic Goals and Targets.	• Support the delivery of GCAP Actions by proactively engaging with action development and providing guidance on their implementation. • Provide technical and operational input to facilitate implementation. • Collaborate across departments and with external stakeholders. • Support the GCAP Coordinator in monitoring tasks, in particular collecting relevant data to feed into the PMP and IMP in a timely manner to facilitate monitoring efforts.
GREEN CITY CHAMPIONS (DEPARTMENTAL AND EXTERNAL STAKEHOLDER REPRESENTATIVES)	Green City Champions should be designated representatives of departments and stakeholders who are involved in helping to guide the development of the Green City Actions through collaboration and consultation. These could be members who have already been involved with the GCAP development process, and stakeholder engagement events and those who are aware of the GCAP and can drive its Green City Agenda within their organisation. They will be responsible for providing input and feedback as actions are implemented.	• Provide feedback and advice on the implementation of Actions, this could be in the form of further stakeholder engagement; • Promote the GCAP and its Actions within their organisation/department to drive buy-in. • Act as ambassadors for the Green City Agenda and help foster a collaborative spirit in Action implementation.

Table A24: Key roles for GCAP implementation and monitoring

Source: AtkinsRéalis analysis

Bursa GCAP I&M Governance Structure



Green City Champions

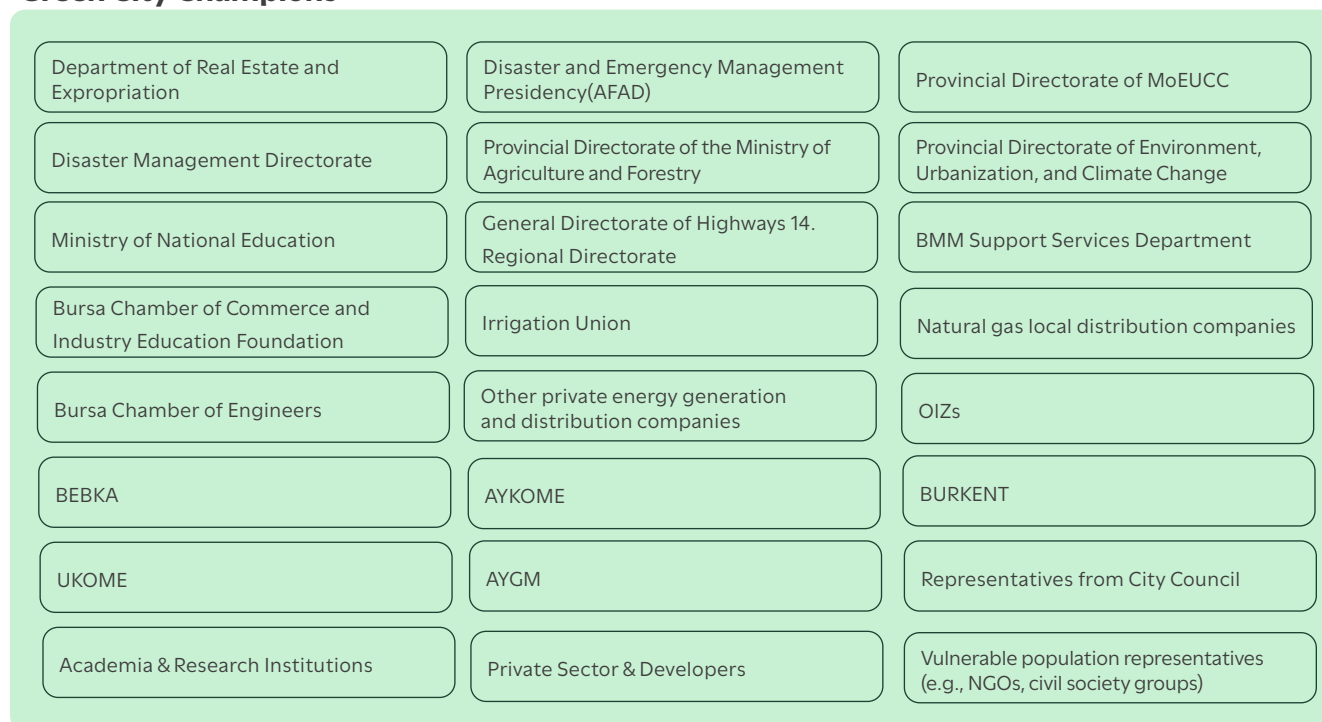


Figure A25: Governance structure for GCAP implementation and monitoring

Source: AtkinsRéalis analysis

Monitoring Implementation and Impact

PROGRESS MONITORING PLAN

OVERVIEW

The PMP sets out the **Green City Actions, broken down by each GCAP sector**, and includes their implementation agency and key milestones, such as the implementation timeframe or CAPEX and OPEX allocated (see Figure A26). It aims to provide **an updated understanding of the status of action implementation over time**, including budget spent and achievements of key milestones.

TIMEFRAME

The PMP should be **populated at the end of the GCAP development process** and will be **updated within a year** of the GCAP being adopted, and **then at least annually thereafter**.

DELIVERABLES

- Fully update the PMP within the proposed timeframes.
- **Create a Progress Monitoring Report**, to feed into the Annual Report

INVOLVEMENT OF I&M ROLES

- **GCAP Implementation Steering Committee** – Will provide strategic oversight of the PMP, they will assist in resolving any barriers in collecting relevant data, and review and approve annual progress reports produced by the GCAP Coordinator.
- **GCAP Coordinator** – Will liaise with the GCAP Delivery Team to request and collect relevant action implementation data. They will populate the PMP with this data and produce annual reports to be approved by the GCAP Implementation Steering Committee.
- **GCAP Delivery Team** – Will support the GCAP coordinator in collecting relevant action implementation data and providing it in a timely manner.

CITY	VISION	SECTORAL TARGETS 5 YEAR MID-TERM TARGETS
Bursa	A resilient, innovative, liveable and happy City that implements sustainability principles with common sense and respects its historical, cultural and natural heritage.	• Protect, develop and make more accessible natural areas, green spaces and social infrastructure. • Deploy an integrated, transparent, and well-enforced sustainable planning system. and respects its historical, cultural and natural heritage.
SECTOR Land Use		

Action Code	GCAP Actions	Investment /Policy	GCAP Action Classification	Implementing Body
1	Develop a ‘City Guide’	Investment	Capital Investment	BMM Department of Zoning and Urbanisation
2	Develop neighbourhood-scale urban transformation strategies	Policy	Strategies, plans and programmes	BMM Department of Urban Transformation
3	Undertake urban redevelopment along planned metro lines	Investment	Capital Investment	BMM Department of Zoning and Urbanisation
4	Establish green belts around OIZs	Investment	Capital Investment	BMM Department of Zoning and Urbanisation BMM Department of Parks and Gardens

Figure A26: Extract from Progress Monitoring Plan
Source: AtkinsRéalis

IMPACT MONITORING PLAN

OVERVIEW

The IMP sets out the **Targets developed for each of the Strategic Goals** alongside their baseline conditions, where possible, for which each target will be assessed against (see Figure A27). It aims to **assess the effective impact of actions against the Strategic Goals and Targets** that were established, for instance, decreasing non-revenue water and increasing per capita green spaces.

TIMEFRAME

The IMP should be **populated at the end of the GCAP development process and will be updated after three years and five years** thereafter to report on the environmental, social and economic impact of the GCAP.

DELIVERABLES

- Fully update the IMP within the proposed timeframe.
- **Create an Impact Progress Report**, at the end of the third and fifth years, to feed into the Annual Monitoring Report.

INVOLVEMENT OF I&M ROLES

- **GCAP Implementation Steering Committee** – Will provide strategic oversight of the IMP, they will assist in resolving any barriers in collecting relevant data, and review and approve progress reports at key time intervals produced by the GCAP Coordinator.
- **GCAP Coordinator** – Will liaise with the GCAP Delivery Team and Green City Champions to request and collect relevant impact data relating to the GCAP Targets. They will populate the IMP with this data and produce monitoring reports at key time intervals to be approved by the GCAP Implementation Steering Committee.
- **GCAP Delivery Team** – Will support the GCAP coordinator in collecting relevant impact data relating to the GCAP Targets and providing it in a timely manner.
- **Green City Champions** – Will support the GCAP coordinator in collecting relevant impact data relating to the GCAP Targets and providing it in a timely manner.



Irgandı Çarşılı Bridge, Yıldırım

CITY COUNTRY

Bursa Türkiye

Indicators	Indicator Code	Sector	Colour code	Current figure (latest available)	Target figure	Unit	Data Source / Contact Detail	Related Actions
Per capita green space across each urban district is greater than 15 m².	6	Land Use		12	15	m²	BMM Department of Zoning and Urbanisation	2, 3, 4, 5, 31, 32
70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip)	6/2	Land Use		46	70	%	BMM Department of Zoning and Urbanisation BMM Department for parks	2, 3, 5, 32
At least 6 OIZs are certified as Green OIZs.	N/A	Industries		3	6	N0.	Bursa Chamber of Commerce, BTSO	10, 11
100% of the municipal population is served by a wastewater treatment plant.	26	Water		86.8	100	%	BUSKI	20, 30, 32
Non-revenue water in each district is lower than 26%.	25.1	Water		19.5 in Urban Districts 45 across Rural Districts	26	%	BUSKI	19
Share of renewable energy use in total energy consumption is greater than 50%.	16	Energy		19.3	50	%	EUAS, TEIAS, TEDAS and UEDAS	22, 23, 24
Number of electricity interruptions are less than 13 per year per customer.	14.1	Energy		18.6	13	Per Years/ Per Customer	Energy Efficiency Centre (EEC) under BTSO	21
Recycling rates in each district is greater than 35%.	30.1	Solid Waste		2	35	%	BMM Department of Environmental Protection	26, 27, 28

Figure A27: Extract from Impact Monitoring Plan

Source: AtkinsRéalis

Operationalising the GCAP

The Bursa GCAP is a strategic document that will be used by BMM to communicate its Green City Vision and as a roadmap for realising its ambitions. It presents long-term aspirations and priority actions for BMM in the short and medium term.

The **expected improvements in environmental, economic and social performance as a result of implementing the GCAP are reflected in its Strategic Goals and Targets** that will be used to measure its implementation progress and outcomes. However, to realise the transformative potential of the GCAP, the momentum generated during its development will need to be maintained.

Considering expected timing of GCAP adoption in late 2025, a concerted effort should be made to ensure that the GCAP is operationalised beginning no later than early 2026. This will mark the start of the 5-year implementation period to implement a series of GCAP actions with a holistic and integrated approach that is fully aligned with and embedded within BMM's sustainable urban development framework.

BMM will need to make an informed decision on which actions from the GCAP to implement. **This will require further analysis of each proposal, including funding, resource availability, potential revenue generation, as well as political and public support.** This has already been undertaken at a high level as part of the development of Green City Actions for the Bursa GCAP, with some actions previously proposed already being abandoned owing to factors including insufficient political or stakeholder support, complex institutional and implementation frameworks, insufficient resources and funding. However, further detailed feasibility studies and modelling studies, which are objective assessments of the practicality of proposed Green City Actions, will need to be conducted to solidify further action implementation.

The **risks associated with operationalising the GCAP must be identified and rigorously reviewed** at the beginning of the implementation period, and risk management measures should be designed and adopted. The effectiveness of these risk management measures will be apparent in the GCAP monitoring stage, where the implementation progress of GCAP actions and their impact on the local environment will be recorded and analysed.

See Table A26 for a breakdown of the next steps associated with operationalising the Bursa GCAP.

Activity		2025	2026	2027	2028	2029	2030	2031
GCAP Implementation	Approve the Bursa GCAP.							
	Confirm GCAP Coordinator for the implementation phase.							
	Engage politicians, GCAP Implementation Steering Committee, and other decision-makers.							
	Include the GCAP actions in the annual budget and mid/long-term development plans.							
	Review and mitigate GCAP implementation risk.							
	Commission feasibility studies for GCAP actions.							
	Pursue sources of funding.							
	Select key Green City Actions and prepare a detailed implementation plan.							
	Establish and formalise implementation partnerships.							
	Implement Green City Actions.							
GCAP Monitoring	Agree and refine the monitoring process.							
	Monitoring GCAP implementation.							
	Monitor the contribution of GCAP towards Strategic Goals and Targets.							
	Report GCAP implementation progress and plan and implement any necessary corrective measures.							
	Report the contribution of GCAP actions towards Targets and plan and implement any necessary corrective measures.							
	Identify and report on changes in environmental indicators.							
	Prepare for the next GCAP cycle.							

Table A25: Next steps for operationalising the GCAP

Source: AtkinsRéalis analysis



PART B

Green City Action Cards

Guide to Reading Action Cards

Relevant Themes

Sectors and key topics that the Action relates to.

Action Number and Title

Action Description

Short summary for the Action.

Rationale

Brief description of how the Action will address environmental challenges.

Components

Details the key components of the Action.

ACTION 3

Undertake urban redevelopment along planned metro lines

Implement a transit-oriented urban redevelopment project near a planned metro station.

RELEVANT THEMES

landuse transport TOD sustainability resilience NBS NCV G&E

Capital Investment (Programme)	
BMM Department of Zoning and Urbanisation	
At a future station along the planned M4 Metro Line	
New	
Long (> 5 years)	
Development/advisory costs – € 600,000 (£ 27,000,000)	
Capital costs – € 429,700,000 (£ 19,336,500,000)	
Operational costs (over 5 years) – € 235,000 (£ 10,575,000)	
Climate Resilience (Direct) Smart (Direct) GHG Emissions (Direct) NCV (Direct) G&E (Direct)	
ACTION 13 Expand the metro / light rail network	
ACTION 14 Develop micro-mobility infrastructure across Bursa	
Land Use	
• Protect, develop and make more accessible natural areas, green spaces and social infrastructure.	
• Per capita green space across each urban district is greater than 15 m ² .	
• 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip)	
• Deploy an integrated, transparent, and well-enforced sustainable planning system.	
Transport	
Improve integration between different transport modes for urban and rural residents that take into account land use and urban growth patterns.	
8 – Decent work and economic growth	
11 – Sustainable cities and communities	
13 – Climate Action	
15 – Life on Land	

Population and urban growth dynamics in Bursa City over the past few decades have resulted in high rates of urban expansion and sprawl in its north, east and west directions. This has led to increased distance between houses, jobs and services resulting in growing rates of private car ownership, at 8.3% a year, and a decrease in public transit use from 43.27% in 2011 to 39.72% in 2018. Simultaneously, while green space provision is moderate across the city, accessibility to urban open space is uneven and limited, particularly within built-up areas – with only 23% of green space areas sitting within urban limits.

In response, the focus of this action is the proposed implementation of an urban redevelopment project, utilising principles of Transit Oriented Development (TOD) and land-value capture, centred around a future metro station along the M4 Metro Line which aims to construct in the future. The project will serve as a model for replicating sustainable urban development and financing large urban redevelopment projects in Bursa, while also helping to facilitate a modal shift towards public transport, reduce vehicle GHG emissions, and foster sustainable urban growth.

TOD is an urban planning strategy aimed at creating compact, walkable, and sustainable communities centred around high-quality public transport systems. By integrating high and medium-density residences with commercial, recreational, and mixed-use spaces near transport hubs (see Figure 2), TOD reduces car dependency, enhances accessibility, and fosters vibrant, liveable neighbourhoods. Typically, TOD principles are applied to a radius no more than 800m from a public transport station to ensure access to all amenities and public transport is within walking distance of the station.

COMPONENTS

1 DEVELOPMENT OF A MIXED-USE URBAN NEIGHBOURHOOD

to create a vibrant and diverse community that integrates residential, commercial and recreational land use. Large buildings and apartment complexes should be mixed-use where the ground floors are occupied with retail, cafes, and community services, while upper floors provide various housing options, including affordable housing, and offices. The mix of uses will promote walkability and reduce car dependency.

2 ENSURING SEAMLESS INTEGRATION OF PUBLIC AND NON-MOTORISED TRANSPORT

to provide access to public transport and facilitate a smooth transition between different modes, including walking and cycling, through the development of a transfer hub. Streets and junctions should be designed with pedestrians and cyclists in mind, including segregated cycle lanes, bike-sharing facilities and micro-mobility parking areas. Streets should also include traffic calming measures, such as roundabouts and speedbumps, to enhance pedestrian and cyclist safety.

3 DEVELOPING A COHERENT PUBLIC REALM AND STREETSCAPE

to create a legible, attractive and safe public realm connecting key green spaces, community facilities and the transport hub. Streetscapes should include high-quality and uniform paving, street furniture, quality nighttime lighting and signage for easy wayfinding. NBS and SuDS should be integrated into the public realm and streetscape to enhance climate resilience.

4 PROVIDING A NETWORK OF GREEN AND PUBLIC OPEN SPACE AND SOCIAL AMENITIES

for residents and visitors to facilitate access to quality green space and build climate resilience by capitalising on the numerous benefits offered by NBS, including flood alleviation, shading and extreme heat mitigation, carbon sequestration, among others. These spaces should be designed with accessibility for all in mind to ensure all users can benefit from the spaces.

To fund the delivery of infrastructure and public realm improvements within the urban redevelopment area, the use of the following land-based financing tools 'planning gains' from property value near planned stations should be explored":

• **Developer obligations** (Reconstruction Law 3194

(1985); Regulation for the Preparation of Spatial Plans (2014)) – these are in-kind obligations negotiated in Plan Notes or planning agreements, requiring developers to provide land, public spaces, roads, and parking spaces to compensate for the impact of new developments on local infrastructure.

• **Infrastructure levy** (Articles 86 to 94 of Municipal Revenues Act 2464 (1981)) – local governments frequently adopt this levy to recoup part of the costs of new public infrastructure, such as roads, metro constructions and sewage and water utilities, from property owners who benefit from these infrastructures.

• **Land readjustment** (Article 18 of Land Development Law 3194 (1985), Article 10-c of Amnesty Law 2981/3290 and Law 5793) – this mechanism is used to restructure property patterns in both public and private projects, allowing for urban expansion and renewal by pooling and redistributing land parcels.

• **Strategic land management** (State Procurement Law 2886 (1986), Mass Housing Law 2985 (1984) and Regulation on Management of Treasury Immovables (2007) – mechanism to allow for partnering with private developers through models like the Revenue Share Model, where developers finance and build projects on public land and share the revenues with the government.

• **Charges for development rights** (Additional Article 8 Land Development Law 3194 (1985, amended in 2020)) – introduced in 2020, these charges are levied for granting additional development rights, such as higher density or rezoning, and are implemented by national, metropolitan, and local governments.

To ensure effective implementation, a collaborative project structure between the public and private sectors should be established with a joint project steering committee formed to oversee coordination and monitor progress, inclusive of representatives from both public and private sector. The roles of the public and private sector are as below:

• **Public sector** (led by BMM) - Responsible for strategic and spatial planning, developing the relevant regulatory framework, land assembly, and provision of key infrastructure; and

• **Private sector** (engaged through procurement at each step) - Financing, designing and construction of the mixed-used developments, public realm and landscaping and social infrastructure.

The proposed future stations which should be targeted for urban redevelopment could include Acemir Station near the Atatürk Stadium and Gürsu Station (see Figure 3):

Key information

Provides a snapshot of the key characteristics of the Green City Action.



Action Type

Whether the Action is a Capital Investment (Project / Programme); Strategy / Plan / Study; Capacity-building / Awareness Programme; or Data / Monitoring System.



Implementing Agency

BMM Department or organisation responsible for delivery of the Action.



Location

If relevant, Action's district or specific location in Bursa.



Action Status

Whether the Action is New, Ongoing, or Planned for implementation.



Implementation Timeframe

Short (< 2 years); Medium (2-5 years); or Long (>5 years) timeframe to begin implementation of the Action.



Indicative Costs

Estimates of capital expenses, operating expenses (for 5 years), and development / advisory costs for Action implementation.



Co-benefits

Whether the Action has a Direct, Indirect or No Impact on key cross-cutting themes.



Related Actions

Other Green City Actions related to this Action.



Contribution to Sectoral Targets

Sectoral Targets to use for monitoring impacts of the Action.



Related UN SDGs

UN Sustainable Development Goals that the Action aligns with.

Implementation

Provides the key information associated with the implementation of the Green City Action.



Implementation Considerations

Key risks and critical success factors that must be considered during implementation of the Action.



Key Stakeholders

When and how to involve various stakeholder groups during implementation of the Action.



Potential funding and financing sources

Types of funding and financing instruments that might be suitable to consider for the Action.



Revenue generation or cost saving opportunities

Whether the Action helps generate savings or revenues for the Action Owner.

Timeline

Outlines the sequence and timelines of key steps for implementing the Action.

TIMELINES

0-3 MONTHS

Develop a stakeholder engagement plan to identify key public and private stakeholders and engagement activities to keep stakeholders and the general public informed through the development of the action.

3-6 MONTHS

Undertake a detailed site selection study to identify the most appropriate station for the urban redevelopment to be undertaken along the M4 Metro Line. This should also identify appropriate land parcels which can be redeveloped for affordable housing, mixed-uses, green spaces and social services.

6-18 MONTHS

Review and amend relevant planning and zoning regulations, with the aim of supporting higher densities, mixed-use development, parking reductions and active ground-floor requirements. This should also look into introducing land value capture mechanisms through legal instruments and policy reform within the regulatory power of BMM if required.

6-24 MONTHS

Prepare a detailed masterplan, and undertake any necessary due diligence and feasibility studies, this includes allocating various land uses, designing buildings, green and public spaces, public realm and transport infrastructure, including the new station, streets and non-motorized transport provision. This should also include obtaining any necessary planning and construction licences and renewable energy generation licences.

24-60+ MONTHS

Begin phased implementation of the urban redevelopment project, including procurement and implementation of priority infrastructure improvements, such as, street and their respective pedestrian walkways and cycling lanes, public spaces, the public transit stations and transfer hub and green spaces; and release key parcels of land for development of mixed-use buildings through public-private partnerships or direct developer agreement.

OPTION 1: ACEMLER STATION NEAR THE ATATURK STADIUM

Acemler Station is found towards the west of Bursa City near to the Ataturk Stadium and set within an existing urban context. The option has the following advantages and disadvantages:

Advantages

- Existing mass transit hub served by the M1 and M2 Metro lines.
- Access to prominent public facilities such as the Ataturk Stadium and close proximity to public spaces and the Nilüfer Stream.
- Availability of greenfield and brownfield land available for redevelopment to the east of the station.

Disadvantages

- Complex urban area requiring the urban redevelopment to be well integrated into the existing urban fabric.
- Potentially higher costs associated with higher land value given the urban nature.

OPTION 2: GÜRSU STATION

The future Gürsu Station is located to the east of Bursa City and is in close proximity to Kestel and key OIZs and set within an existing rural context. The option has the following advantages and disadvantages:

Advantages

- Proximity to future Gürsu High Speed Railway Station unlocking new transport connections.
- Potential lower costs associated with lower land value given rural nature.

Disadvantages

- Need for demolish existing low-density housing as well as rural setting resulting in a conflict between urban and rural land uses.
- Close proximity to OIZ as potential pollution sources.
- Potential lack of community and stakeholder support due to rural nature and need to avoid loss of agricultural land.

IMPLEMENTATION

IMPLEMENTATION CONSIDERATIONS

- Preference should be given to sites with **consolidated ownership or publicly owned land** to facilitate the implementation.
- TOD principles should be embedded into local development plans** to ensure consistency and scalability.
- Strong communication should be established between the planning, transport and finance departments** to ensure coherent delivery and effective governance.
- Phasing delivery must be informed by market demand** and infrastructure capacity to ensure delivery viability.
- There is a need to undertake continuous stakeholder engagement** is critical to ensure the coordination of efforts and to keep relevant stakeholders and the general public informed throughout action development.



KEY STAKEHOLDERS

- BMM Department of Zoning and Urbanisation – Implementing Agency – All Steps.
- BMM Department of Real Estate and Expropriation – Involve and Collaborate – All Steps.
- BMM Department of Transportation – Involve and Collaborate – Steps 1, 2, and 4

- BEBKA – Involve and Inform – All Steps
- Private developers – Inform and Consult – Steps 1, 2, 4 and 5.
- Local residents – Inform and Consult – Steps 1, 2, 4 and 5.



POTENTIAL FUNDING AND FINANCING SOURCES

- Own Source** – BMM budget associated for road, transport, green space and social amenity development, or revenues from land value capture mechanisms (sale / lease of housing or commercial units, tax increments etc.).
- Grants** – National government, IFIs (for project preparation) and development organisations.
- Loans** – Ilbank, IFIs, and commercial banks.
- Private Investment – Financing can be provided by establishing public** – private partnerships, equity investments or commercial loans secured against income from lease or sale of housing / commercial units.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes – in addition to the land-value capture mechanisms, revenue can also be generated through long-term leases of public land, transit-linked retail, and increased property tax revenues.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

The action **offers direct G&EI outcomes and benefits** by improving equitable access to jobs, education, and services through concentrating mixed-use development around public transport. The Urban Redevelopment Projects should be designed with accessibility for all in mind, including uniform surfaces, ramps, high-quality lighting, etc.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

The action **offers direct opportunities to build climate and disaster resilience**, in particular through the design of the urban redevelopment projects as well as the buildings within them. Buildings should be designed adhering to the latest seismic codes to withstand seismic risks avoiding areas prone to landslide and liquefaction. NbS and SuDS should be incorporated into green spaces and along transport routes to capitalise on multiple ecosystem benefits offered by green infrastructure, including flood alleviation and heat mitigation.



IMPACT ON GHG EMISSION REDUCTION

Possible to achieve GHG emission reduction →

increasing the number of people living close to public transport thus encouraging its use, as well as promoting active travel through good design. Low low-carbon approach in design, construction and operations should be implemented to further reduce embodied carbon. Any NbS as part of the action will have the potential to sequester carbon.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

The action offers some smart outcomes and benefits through opportunities to incorporate data-informed urban management by integrating spatial data on land use, transport access, and development phasing. There are also opportunities to integrate IoT devices and smart city data monitoring to improve the management of municipal services.



IMPACT ON NATURAL CAPITAL VALUE

This action **has the potential to deliver direct natural capital value benefits** through improvements to pedestrian accessibility to high-quality green spaces, which will increase the value of recreation and health and wellbeing services. Incorporating NbS will also offer wider benefits such as flood regulation and local climate regulation.

Impact

Provides an overview of the key impacts and co-benefits delivered as a result of the implementation of the Green City Action.



Gender and economic inclusion considerations and co-benefits



Climate and disaster resilience considerations and co-benefits



Smart maturity considerations and co-benefits



Impact on GHG emission reduction

Action's contribution to GHG emissions reduction; quantification of GHG emissions reductions for Actions with a direct impact.



Impact on Natural Capital Value

Action's contribution to enhancing NCV in Bursa; quantification of NCV benefits for Actions with a direct impact.

Land Use

01

Develop a “City Guide”

02

Develop neighbourhood-scale urban transformation strategies

03

Undertake urban redevelopment along planned metro lines

04

Establish green belts around OIZs

05

Transform existing industrial area in Kestel or Gürsu Districts





Bursa Conquest Museum, Osmangazi

Develop a 'City Guide'

Develop a comprehensive digital platform integrating various geospatial data relevant to urban planning from all sectors.

RELEVANT THEMES

#landuse #buildings #digital

	Capital Investment (Programme) Data / Monitoring System Capacity Building / Awareness Programme
	BMM Department of IT (BMM GIS Branch Directorate)
	Bursa-wide
	Ongoing
	Short (< 2 years)
	€ 0 Development/advisory costs € 265,000 Capital costs € 50,000 Operational costs (over 5 years)
	Direct Climate Resilience None GHG Emissions Indirect G&EI Direct Smart Indirect NCV
	ACTION 6 Develop a digital database for buildings ACTION 29 Develop a digital dashboard for air, noise, water and soil quality monitoring
	Land use – Data relevant for planning permissions is publicly available in a digitised/online format for 100% of land parcels.
	4 – Quality Education 11 – Sustainable cities and communities 13 – Climate Action 14 – Life Below Water 15 – Life on Land

Geographic Information Systems (GIS) and geospatial data are commonly used to inform and produce plans and policies for the city, including, the Bursa 1:100.000 Environment Plan of Transport Master Plan. This demonstrates awareness and knowledge in using such digital tools and data. However, currently there is no consolidated data source which is used by different agencies. Moreover, multiple agencies and departments have their own geospatial data sets. Often, data is not shared between agencies, institutions and the general public. This is particularly an issue for climate risk and hazard geospatial data, such as urban flooding, which is collected and developed by AFAD and its Provincial Directorate.

In line with ongoing activities to establish such platform, **this action seeks to enhance collaboration and geospatial data sharing between various stakeholders, government agencies and BMM departments** by establishing a spatial common data environment for geospatial data, and developing a 'City Guide' dashboard which eventually should be accessible to the general public.

COMPONENTS

1 DEVELOPMENT OF THE DIGITAL 'CITY GUIDE'

The 'City Guide' should be established as a central repository of geospatial data, which will enable continuous monitoring and evaluation of various geospatial data sets and encourage intersectoral coordination between various agencies, institutions and departments. This includes:

- **Establishing data sharing protocol** between various stakeholders and geospatial data standards to ensure agreement and understanding between stakeholders. In doing so implementation of best practices for data storage and sharing, including, standardisation of metadata, such as naming conventions, geographic projection, and attribute features.
- **Collecting existing geospatial data from various agencies** and where necessary augmented to meet the new standards and protocols.
- If necessary **digitise data sets and develop new geospatial data**, using drones and remote sensing for example, to ensure a comprehensive set of geospatial data is available, including, transport, utilities, hydrology, contaminated land sites, community and public facilities, environment indicators (linked to Action

29), green spaces and protected areas, biodiversity, demographics and socioeconomics (Especially lower income groups and gender-based intersectional issues), land use types and ownership, cadastral information, buildings and historic sites, topography, areas at risk of river and urban flooding, landslides, soil erosion, environmentally sensitive areas, etc.

- **Establishing the need for additional or improved digital infrastructure and servers** to host the spatial common data environment and web-map, should include any necessary security infrastructure and protocols.
- **Develop a simple and easy-to-use web map** and integrate it as part of the BMM website, or as a standalone service, to disseminate geospatial information which can be accessed by stakeholders and the general public to view and utilise when needed.

Compiling this data and information will assist in the future development of a Bursa Digital Twin if the need for this arises. The digital twin could then be used as a test bed for future planned transport and land use interventions and inform evidence-based decision making.

2 AWARENESS BUILDING AND DIGITAL SKILLS DEVELOPMENT

Awareness building and training sessions to develop digital skills should be provided to BMM employees; and the potential to expand awareness building and digital skills development to the general public explored, especially for underserved groups. Such training should provide users with a comprehensive understanding of geospatial data, digital tools and an overview of the web map, its capabilities and use cases.

TIMELINES

0-3 MONTHS

Establishing data sharing protocols and geospatial data standards.

3-6 MONTHS

Coordination of stakeholders and obtaining buy-in from various agencies, departments and institutions.

6-12 MONTHS

Developing the spatial common data environment and web map and establishing necessary infrastructure, for example, new servers.

6-12 MONTHS

Gathering geospatial data from various stakeholders, modifying it when needed, and/or digitising and developing new data sets.

12-15 MONTHS

Integrating geospatial data with the spatial common data environment and web-map, completed in consultation with the BMM Department of IT. Road testing the new digital tools with various stakeholders.

15-16 MONTHS

Developing awareness-raising and digital training material.

16+ MONTHS

Launching the web map and delivering awareness-raising and digital training to BMM staff and if deemed necessary the general public.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Coordination between various stakeholders** to collect geospatial data.
- Potential need to **license map data**.
- Need for **dedicated servers and data storage**.
- **Need for funding** to obtain fee-based data.



KEY STAKEHOLDERS

- **BMM Department of IT (BMM GIS Branch Directorate) – Implementation Agency** – all components and steps
- **BMM Department of Zoning and Urbanization – Involve and Collaborate** – all components and steps
- **All other BMM departments** – Involve and Collaborate – all components and steps 2, 4 and 7.
- **Other related public institutions and their subsidiaries** – Collaborate – all components and steps



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to develop digital tools and manage data repositories, and for zoning and urbanisation activities.
- **Grant** – National government, IFIs (for project preparation) and development organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

No direct revenue generation or cost saving opportunities as a result of this action.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Geospatial data disaggregated for different demographic categories should be explored. Moreover, Component 2 provides opportunities to target capacity building and digital skills training to underserved groups, including women, youth, elderly, and people with disabilities. Any digital tool developed should be accessible to all.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Compiling geospatial data into a single source of truth, informed by risk exposure, will facilitate an improved understanding of the interactions between various land uses, buildings and assets, and climate and disaster-related risks and hazards. For example, flood maps will help to identify areas of the city and buildings impacted by urban flooding. This will also help to provide guidance and information on potential mitigation and adaptation measures to reduce the impact of climate and disaster risks as well as build long-term resilience.



IMPACT ON GHG EMISSION REDUCTION

No impact



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – It will improve BMM's capabilities in handling, presenting and utilising geospatial data to its full potential.

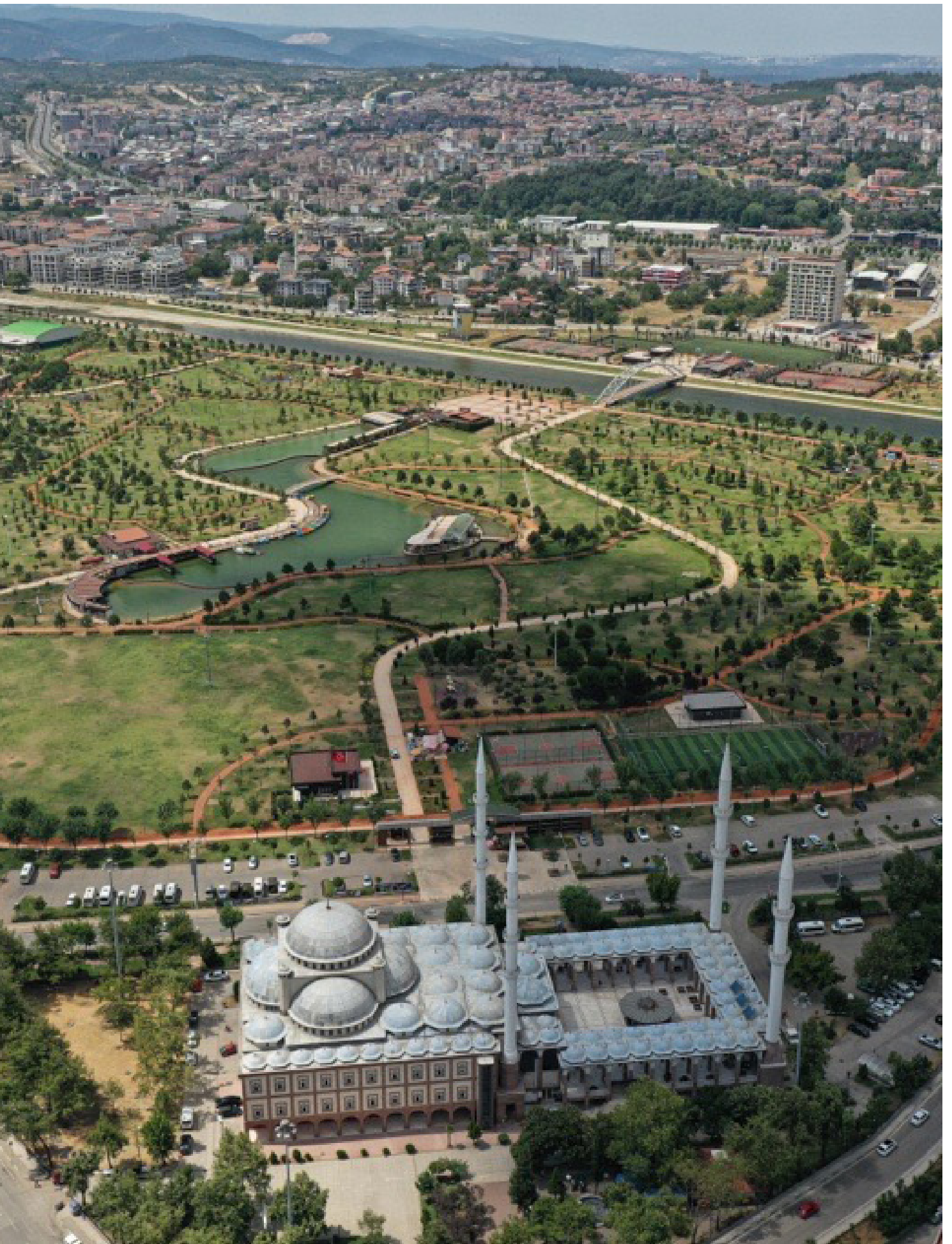


IMPACT ON NATURAL CAPITAL VALUE

Indirect impacts – Compiling geospatial data can aid in identifying and monitoring ecosystems and the services they provide. This data can then be used to support planning and/or financing initiatives.



Hüdavendigar City Park



Develop neighbourhood-scale urban transformation strategies

Develop strategies for neighbourhood-wide urban transformation initiatives, aligned with historical context and upper-scale plans.

RELEVANT THEMES

#landuse #buildings #energyefficiency #NBS
#sustainablemobility #resilience #NCV #G&EI

	Strategy / Plan / Study
	BMM Department of Urban Transformation
	Urban districts (all or mostly) focusing on Yıldırım District at first
	New and Ongoing
	Medium (2-5 years)
	€ 1,000,000 Development/advisory costs € 0 Capital costs € 0 Operational costs (over 5 years)
	Direct Climate Resilience Indirect GHG Emissions Direct G&EI Direct Smart Direct NCV - €2,319,326 annual NCV impact
	None
	Land use – Per capita green space across each urban district is greater than 15 m². Land use – 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip). Land use – 100% of neighbourhoods with a designated UNESCO World Heritage Site have a council-approved Master Development Plan. Buildings – More than 50% of commercial and residential buildings have Energy Performance Certificates.
	5 – Gender Equality 8 – Decent Work and Economic Growth 11 – Sustainable Cities and Communities 13 – Climate Action 15 – Life on Land

Urban transformation⁵⁹ in Türkiye is currently implemented on a site-by-site basis, declared under Law No. 6306 on Restructuring of Areas Under Risk of Natural Disaster. Introduced in 2019, this law enables authorities to identify and redevelop areas where buildings are considered structurally at risk – particularly in earthquake-prone regions. While this mechanism accelerates physical interventions, the lack of a unified vision and approach to urban transformation has often led to urban transformation projects that are incongruous with the neighbourhood's urban form, or do not sufficiently consider historical significance and cultural identity.

This action seeks to redefine urban transformation in historic neighbourhoods through the development of cohesive, neighbourhood-wide plans grounded in sustainability, historical context, and integrated with upper-scale plans. It will be implemented through close collaboration between BMM, District Municipalities, and private contractors.

The programme will focus on the development and application of comprehensive urban transformation guidelines tailored to the cultural and physical context of the pilot area. It will prioritise sustainable building practices, improve energy performance standards for new development, and integrate public realm improvements through pedestrianisation, street re-design, restricted vehicle accesses, and new public green spaces.

COMPONENTS

1 PLANNING AND GOVERNANCE FRAMEWORK

This component will establish a strong institutional foundation to guide neighbourhood-scale transformation across Bursa. It focuses on improving coordination, setting design standards, and supporting localised implementation. It will entail the following actions:

- **Multi-stakeholder taskforce** – composed of representatives from municipal departments, heritage and cultural authorities, urban design experts, private developers and residents. The taskforce should meet regularly to guide neighbourhood transformation priorities and implementation.
- **Urban design guidelines** – rooted in disaster resilience, sustainability, walkability, historic sensitivity, and social inclusion. These will provide

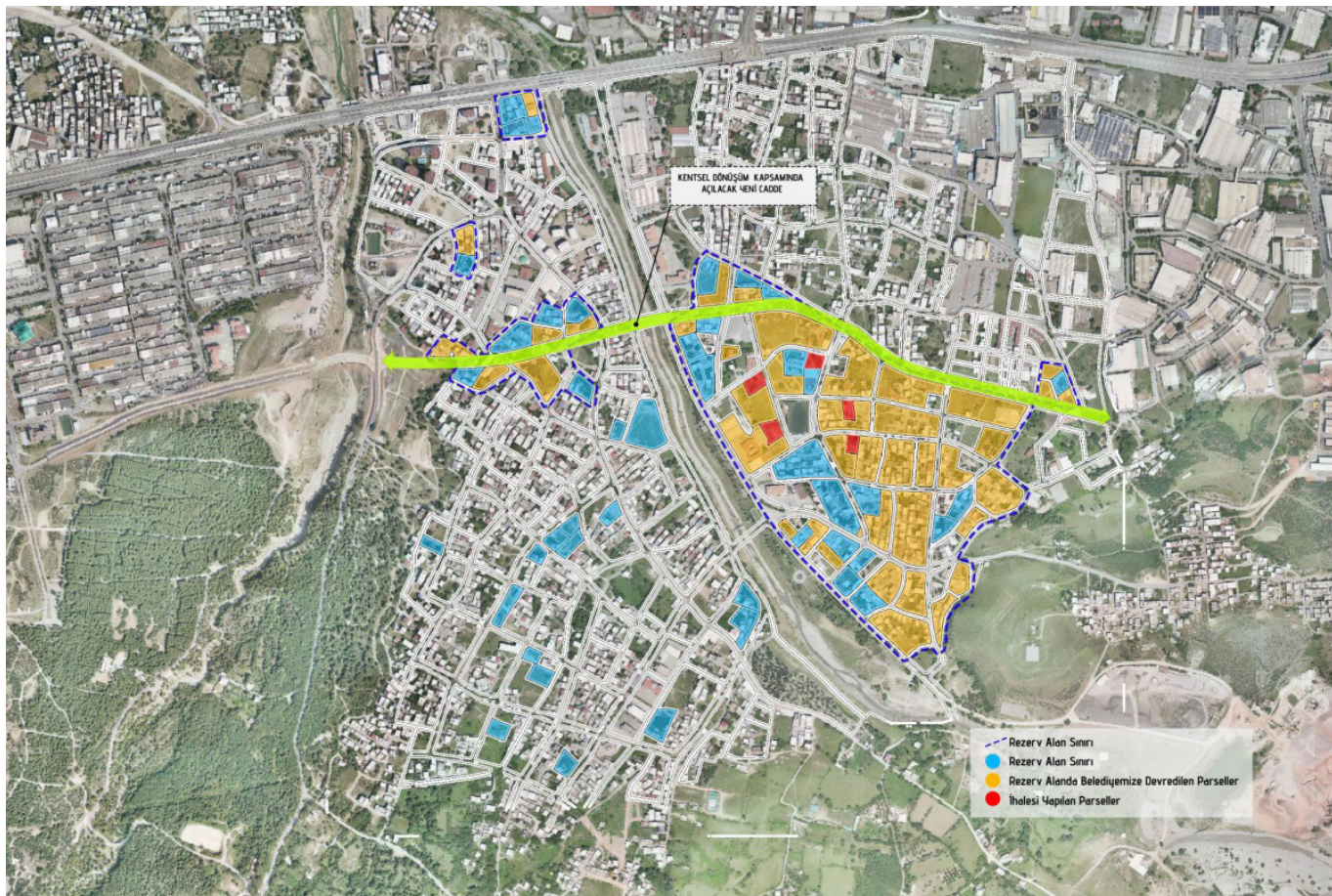


Figure B1: Current plans for the Karapınar - Değirmenönü - Cumalıkızık Urban Transformation Project

Source: BMM⁶⁰

a standard reference for public realm upgrades, building typologies, green space provision, and climate-adaptive features (e.g. shading, permeability, passive cooling).

- **Implementation support** – targeted support for District Municipalities to develop urban regeneration strategies aligned with the design guidelines (Component 2). This should include capacity building, mapping tools, and integration with land-use plans and permitting processes.
- **Funding support** – Establish guidelines within the framework to mobilise and coordinate funding for implementation, including municipal budgets, national grants, international funding, land value capture and developer contributions.

2 URBAN TRANSFORMATION STRATEGIES

This component supports the preparation of comprehensive transformation strategies across selected transformation areas in Bursa. These strategies will be grounded in the urban design guidelines developed under Component 1, ensuring a consistent, integrated and sustainable approach to neighbourhood-scale transformation. Each strategy

will be tailored to local context, and developed in collaboration with local communities and businesses.

The first strategy should focus on the **Karapınar (all neighbourhood) – Değirmenönü (all neighbourhood) – Cumalıkızık (neighbourhood including the area with unauthorised constructions)**, where transformation is already underway. This location provides an immediate opportunity to apply the new framework and integrate sustainability, heritage, and liveability principles. In addition, this action will also cover five urban transformation areas selected from among those announced or planned to be announced under Law No. 6306. The applications in these five selected urban transformation areas will be designed in order according to the date of announcement of the transformation area.

All transformation strategies should be guided by the overarching urban design guidelines from Component 1, and address the following thematic areas:

- **Green space and social amenities** – ensuring well-located, inclusive public and green spaces that support community cohesion, health, and

quality of life - particularly addressing the needs and preferences of women, children, and elderly caregivers in urban settings. Encourage urban greening to enhance microclimates and biodiversity.

- **Integrated transport** – Improve access to public transport, enhance pedestrian and cycling infrastructure, and reduce reliance on private vehicles.
- **Climate resilience and adaptation** – Integrate nature-based solutions (NbS) and sustainable drainage (SuDS) to address flooding, urban heat, and biodiversity loss.
- **Disaster resilience** – Integrate building safety regulations, upgrade of critical infrastructure, and improve emergency access in high-risk zones.
- **Energy efficiency and low-carbon building design** – Strategies should explicitly integrate renewable energy solutions, such as rooftop solar panels, solar water heating, and district-scale clean energy systems. Building designs should also prioritise water efficiency, passive cooling, and smart energy management systems.
- **Local economic development** – Stimulate and create economic opportunities within local neighbourhood through the provision of mixed-use retail spaces tailored to the needs of local businesses, affordable and flexible commercial units, and designated areas for market stalls in green spaces to support small and micro-enterprises. In this context, special emphasis should be placed on supporting women entrepreneurs who operate in or have business initiatives in the green economy sectors.
- **Affordable housing** – Provision of adequate, safe, and affordable housing for all income groups should be prioritised, alongside the promotion of mixed-income developments to foster social inclusion.
- **Culture and heritage** – Conserve historic assets, and ensure new developments reflect and enhance the neighbourhood's cultural character and built form.

Each strategy will include an implementation plan with prioritised actions, timelines, and coordination mechanisms to guide phased delivery and alignment with ongoing investments.

TIMELINES

0-6 MONTHS

Establish the taskforce and align approach with existing plans and national legal frameworks. Early review of case studies such as Doğanbey and the UNESCO World Heritage Sites. Engage and procure private contractors early to ensure alignment.

6-12 MONTHS

Finalise **urban transformation design guidelines** for sustainable, context-sensitive neighbourhood transformation and begin capacity building for localised implementation plans. Simultaneously, conduct diagnostic assessment for the pilot site.

12-24 MONTHS

Develop the **strategy and implementation plan** for the Karapınar – Değirmenönü – Cumalıkızık neighbourhood.

24-48 MONTHS

Integrate the strategy into municipal processes and support alignment of future transformation areas with the programme framework.

48+ MONTHS

Re-visit lessons learned from Step 3 & 4, and develop spatial strategies for five further urban transformation areas declared under Municipal Law No. 6306.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- The taskforce must work closely with legal departments to ensure the process remains consistent with national laws.
- Early engagement with residents is critical to build trust and understanding of neighbourhood needs.
- Collation and review of existing plans across different scales are critical to ensure integration and evidence-based planning.



KEY STAKEHOLDERS

- **BMM Department of Urban Transformation** – Implementing Agency – all components and steps
- **District Municipalities** – Involve and Collaborate – All components and steps
- **BURKENT** – Involve and Collaborate – All components and steps
- **BMM Department of Zoning and Urbanisation** – Involve and Collaborate – All components and steps

- **Ministry of Environment, Urbanization, and Climate Change** – Inform – All components and steps
- **Local residents, women-led entrepreneurship organizations, and local businesses** – Inform and Consult – All components and steps



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned for developing urban planning strategies.
- **Grant** – National government, IFIs (for project preparation) and development organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Revenue streams can be generated through developer contributions, and increased local economic and tourism activity. The programme also opens opportunities for private investment in retrofitting, green infrastructure, and local enterprise development.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – By improving access to green public spaces that are safe for all and equipped with services that meet care needs (e.g., facilities for breastfeeding, childcare, and eldercare), this action can foster more inclusive public spaces. There are opportunities for targeted inclusion of women and youth in the creation of the taskforce. Opportunities to maximise affordable housing and efforts to limit gentrification should be explored. Gender mainstreaming approaches should be taken into consideration when developing strategies.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action offers opportunities to improving structural safety and preparedness in high seismic-risk zones. Any new buildings and public spaces should be built in line with seismic codes and avoid land prone to landslide and liquefaction. There are also opportunities to implement NbS and SuDS capitalising on their multiple ecosystem benefits of flood alleviation and providing shading in public spaces to improve heat resilience.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – GHG emissions reductions may be achieved by applying low carbon approach in construction and operations of buildings, implementing solar Photovoltaic (PV) for energy generation and energy efficiency measures to reduce consumption. Moreover, any onsite NbS will have the potential to sequester carbon.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action includes integration of IoT devices and smart city data systems in the creation of public spaces, supporting long-term innovation in urban governance.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – Improvements through pedestrianisation, new public green spaces, and redesigning streets to prioritise walking and cycling will increase the value of recreation, health and wellbeing, and cultural heritage services.

Estimated annual NCV impact: €2,319,326

This action is likely to have positive impacts on recreation, global climate regulation, and flood regulation ecosystem services. Ecosystem service impacts not valued, considering the 'top-down' valuation approach used for this Action.

59. The terms "transformation," "regeneration," and "redevelopment" are used broadly within this document and may overlap but mean the same thing. "Transformation" is a specific term used in the Turkish context and law and is often used to suggest "regeneration" and "redevelopment", which focus more on neighbourhood renewal and physical reconstruction, respectively.

60. BMM - Projects, 2025. Available at: <https://www.bursa.bel.tr/projeler/karapinar---degirmenonu---cumalikizik-kentsel-donusum-projesi-236>

Undertake urban redevelopment along planned metro lines

Implement a transit-oriented urban redevelopment project near a planned metro station.

RELEVANT THEMES

#landuse #transport #TOD #sustainablemobility
#resilience #NBS #NCV #G&EI

	Capital Investment (Programme)
	BMM Department of Zoning and Urbanisation
	At a future station along the planned M4 Metro Line
	New
	Long (> 5 years)
	€ 600,000 Development/advisory costs € 429,700,000 Capital costs € 235,000 Operational costs (over 5 years)
	Direct Climate Resilience Direct GHG Emissions Direct G&EI Direct Smart Direct NCV - €2,319,326 annual NCV impact
	ACTION 13 Expand the metro / light rail network ACTION 14 Develop micro-mobility infrastructure across Bursa
	Land use – Per capita green space across each urban district is greater than 15 m ² . Land use – 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip) Climate & Environment – Tree canopy cover in each district is greater than 20%.
	5 – Gender equality 8 – Decent work and economic growth 11 – Sustainable cities and communities 13 – Climate Action 15 – Life on Land

Population and urban growth dynamics in Bursa over the past few decades have resulted in high rates of urban expansion and sprawl to the north, east and west of its urban core. This has led to increased distance between houses, jobs and services resulting in growing rates of private car ownership, at 8.3% a year, and a decrease in public transit use from 43.27% in 2011 to 39.72% in 2018. Simultaneously, while green space provision is moderate across the city, accessibility to urban open space is uneven and limited, particularly within built-up areas – with only 23% of green space areas sitting within urban limits.

In response, **the focus of this action is the implementation of an urban redevelopment project, utilising principles of Transit Oriented Development (TOD) and land-value capture, centred around a suitable metro station along the planned M4 Metro Line.** The project will serve as a model for replicating sustainable urban development and financing large urban redevelopment projects in Bursa, while also helping to facilitate a modal shift towards public transport, reduce vehicle GHG emissions, and foster sustainable urban growth.

TOD is an urban planning strategy aimed at creating compact, walkable, and sustainable communities centred around high-quality public transport systems. By integrating high and medium-density residences with commercial, recreational, and mixed-use spaces near transport hubs (see Figure B2), TOD reduces car dependency, enhances accessibility, and fosters vibrant, liveable neighbourhoods. Typically, TOD principles are applied to a radius no more than 800m from a public transport station to ensure access to all amenities and public transport is within walking distance of the station.

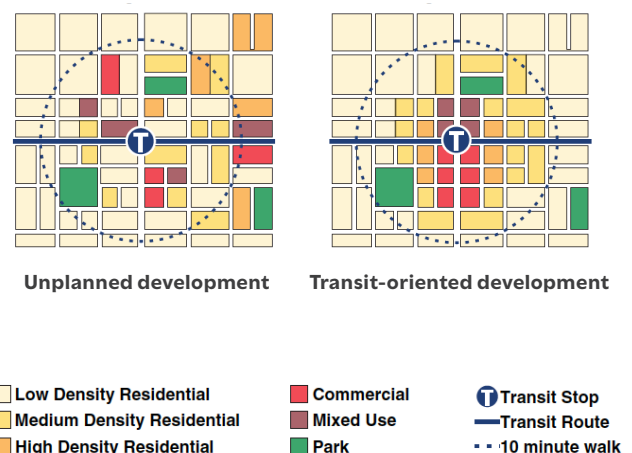


Figure B2: Illustration of TOD concept

Source: Sahu, A, 2018⁶¹

COMPONENTS

1 DEVELOPMENT OF A MIXED-USE URBAN NEIGHBOURHOOD

To create a vibrant and diverse community that integrates residential, commercial and recreational land use. Large buildings and apartment complexes should be mixed-use where the ground floors are occupied with retail, cafes, and community services, while upper floors provide various housing options, including affordable housing, and offices. The mix of uses will promote walkability and reduce car dependency.

2 ENSURING SEAMLESS INTEGRATION OF PUBLIC AND NON-MOTORISED TRANSPORT

To provide access to public transport and facilitate a smooth transition between different modes, including walking and cycling, through the development of a transfer hub. Streets and junctions should be designed with pedestrians and cyclists in mind, including segregated cycle lanes, bike-sharing facilities and micro-mobility parking areas. Streets should also include traffic calming measures, such as roundabouts and speedbumps, to enhance pedestrian and cyclist safety.

3 DEVELOPING A COHERENT PUBLIC REALM AND STREETScape

To create a legible, attractive and safe public realm connecting key green spaces, community facilities and the transport hub. Streetscapes should include high-quality and uniform paving, street furniture, quality night-time lighting and signage for easy wayfinding. NbS and SuDS should be integrated into the public realm and streetscape to enhance climate resilience.

4 PROVIDING A NETWORK OF GREEN AND PUBLIC OPEN SPACE AND SOCIAL AMENITIES

For residents and visitors to facilitate access to quality green space and build climate resilience by capitalising on the numerous benefits offered by NbS, including flood alleviation, shading and extreme heat mitigation, carbon sequestration, among others. These spaces should be designed with accessibility for all in mind to ensure all users can benefit from the spaces. Appropriate mechanisms for maintenance of these green spaces should be explored and secured to ensure their quality and viability over a long time period; this could include setting up a private management contract or incorporating the green spaces into BMM's Department of Parks and Gardens current management remit.

To fund the delivery of infrastructure and public realm improvements within the urban redevelopment area,

the use of the following land-based financing tools 'planning gains' from property value near planned stations should be explored⁶²:

- **Developer obligations** (Reconstruction Law 3194 (1985); Regulation for the Preparation of Spatial Plans (2014)) – these are in-kind obligations negotiated in Plan Notes or planning agreements, requiring developers to provide land, public spaces, roads, and parking spaces to compensate for the impact of new developments on local infrastructure.
- **Infrastructure levy** (Articles 86 to 94 of Municipal Revenues Act 2464 (1981)) – local governments frequently adopt this levy to recoup part of the costs of new public infrastructure, such as roads, metro constructions and sewage and water utilities, from property owners who benefit from these infrastructures.
- **Land readjustment** (Article 18 of Land Development Law 3194 (1985), Article 10-c of Amnesty Law 2981/3290 and Law 5793) – this mechanism is used to restructure property patterns in both public and private projects, allowing for urban expansion and renewal by pooling and redistributing land parcels.
- **Strategic land management** (State Procurement Law 2886 (1986), Mass Housing Law 2985 (1984) and Regulation on Management of Treasury Immovables (2007) – mechanism to allow for partnering with private developers through models like the Revenue Share Model, where developers finance and build projects on public land and share the revenues with the government.
- **Charges for development rights** (Additional Article 8 Land Development Law 3194 (1985, amended in 2020)) – introduced in 2020, these charges are levied for granting additional development rights, such as higher density or rezoning, and are implemented by national, metropolitan, and local governments.

To ensure effective implementation, a collaborative project structure between the public and private sectors should be established with a joint project steering committee formed to oversee coordination and monitor progress, inclusive of representatives from both public and private sector. The roles of the public and private sector are as below:

- **Public sector (led by BMM)** - Responsible for strategic and spatial planning, developing the relevant regulatory framework, land assembly, and provision of key infrastructure; and
- **Private sector (engaged through procurement at each step)** - Financing, designing and construction of the mixed-used developments, public realm and landscaping and social infrastructure.

The proposed future stations which should be targeted for urban redevelopment could include Acemler Station (near the Atatürk Stadium) and Gürsu Station:

OPTION 1: ACEMLER STATION NEAR THE ATATÜRK STADIUM

Acemler Station is found towards the west of Bursa City near to the Atatürk Stadium and set within an existing urban context. The option has the following advantages and disadvantages:

Advantages

- **Existing mass transit hub** served by the M1 and M2 Metro lines.
- **Access to prominent public facilities** such as the Atatürk Stadium and close proximity to public spaces and the Nilüfer Stream.
- **Availability of greenfield and brownfield land** available for redevelopment to the east of the station.

Disadvantages

- **Complex urban area** requiring the urban redevelopment to be well integrated into the existing urban fabric.
- **Potentially higher costs** associated with higher land value given the urban nature.

OPTION 2: GÜRSU STATION

The future Gürsu Station is located to the east of Bursa City and is in close proximity to Kestel and key OIZs and set within an existing rural context. The option has the following advantages and disadvantages:

Advantages

- **Proximity to future Gürsu High Speed Railway Station** unlocking new transport connections.
- **Potential lower costs** associated with lower land value given rural nature.

Disadvantages

- Need for **demolish existing low-density housing** as well as rural setting resulting in a conflict between urban and rural land uses.
- **Close proximity to OIZ** as potential pollution sources.
- **Potential lack of community and stakeholder support** due to rural nature and need to avoid loss of agricultural land.

TIMELINES

0-3 MONTHS

Develop a stakeholder engagement plan to identify key public and private stakeholders and engagement activities to keep stakeholders and the general public informed through the development of the action.

3-6 MONTHS

Undertake a detailed site selection study to identify the most appropriate station for the urban redevelopment to be undertaken along the M4 Metro Line. This should also identify appropriate land parcels, alongside their ownership status, which can be redeveloped for affordable housing, mixed-uses, green spaces and social services.

6-18 MONTHS

Review and amend relevant planning and zoning regulations, with the aim of supporting higher densities, mixed-use development, parking reductions and active ground-floor requirements. This should also look into introducing land value capture mechanisms through legal instruments and policy reform within the regulatory power of BMM if required.

6-24 MONTHS

Prepare a detailed masterplan, and undertake any necessary due diligence and feasibility studies, this includes allocating various land uses, designing buildings, green and public spaces, public realm and transport infrastructure, including the new station, streets and non-motorized transport provision. This should also include obtaining any necessary planning and construction licences and renewable energy generation licences.

24-60+ MONTHS

Begin phased implementation of the urban redevelopment project, including procurement and implementation of priority infrastructure improvements, such as, street and their respective pedestrian walkways and cycling lanes, public spaces, the public transit stations and transfer hub and green spaces; and release key parcels of land for development of mixed-use buildings through public-private partnerships or direct developer agreement.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Preference should be given to sites with **consolidated ownership or publicly owned land** to facilitate the implementation.
- **TOD principles should be embedded into local development plans** to ensure consistency and scalability.
- **Strong communication should be established between the planning, transport and finance departments** to ensure coherent delivery and effective governance.
- **Phasing delivery must be informed by market demand** and infrastructure capacity to ensure delivery viability.

- **There is a need to undertake continuous stakeholder engagement** is critical to ensure the coordination of efforts and to keep relevant stakeholders and the general public informed throughout action development.
- **There is a need to understand land ownership** of development parcels around the stations.



KEY STAKEHOLDERS

- **BMM Department of Zoning and Urbanisation** – Implementing Agency – All Steps.
- **BMM Department of Real Estate and Expropriation** – Involve and Collaborate – All Steps.
- **BMM Department of Transportation** – Involve and Collaborate – Steps 1, 2, and 4
- **BEBKA** – Involve and Inform – All Steps
- **Private developers** – Inform and Consult – Steps 1, 2, 4 and 5.
- **Local residents** – Inform and Consult – Steps 1, 2, 4 and 5.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget associated for road, transport, green space and social amenity development, or revenues from land value capture mechanisms (sale / lease of housing or commercial units, tax increments etc.).
- **Grants** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.
- **Private Investment – Financing can be provided by establishing public** – private partnerships, equity investments or commercial loans secured against income from lease or sale of housing / commercial units.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes
in addition to the land-value capture mechanisms, revenue can also be generated through long-term leases of public land, transit-linked retail, and increased property tax revenues.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action will enable equitable access to jobs, education, and services through concentrating mixed-use development around public transport. Employment opportunities for women and disadvantaged groups should be encouraged and maximised through equal opportunity policies and practices, additional support and skills development. All projects should incorporate inclusive accessibility and safety features aimed at children, the elderly, people with disabilities, and caregivers.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The design of the urban redevelopment projects and the buildings in them should consider climate and disaster resilience principles. Buildings should be designed adhering to the latest seismic codes to withstand seismic risks avoiding areas prone to landslide and liquefaction. NbS and SuDS should be incorporated into green spaces and along transport routes to capitalise on multiple ecosystem benefits offered by green infrastructure, including flood alleviation and heat mitigation.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – By increasing the number of people living close to public transport, promoting its use, and promoting active travel through good design, this action has the potential to reduce GHG emissions in the city. A low-carbon approach to design, construction and operations should be followed to further reduce embodied carbon. Any NbS as part of the action will have the potential to sequester carbon.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action provides opportunities to incorporate data-informed urban management by integrating spatial data on land use, transport access, and development phasing. There are also opportunities to integrate IoT devices and smart city data monitoring to improve the management of municipal services.



IMPACT ON NATURAL CAPITAL VALUE

Direct benefits – Through improvements to pedestrian accessibility to high-quality green spaces, the value of recreation and health and wellbeing natural services will be enhanced. Incorporating NbS will also offer wider benefits such as flood regulation and local climate regulation.

Estimated annual NCV impact: €2,319,326

Ecosystem service impacts estimated using 'bottom-up' approach This action is likely to have a positive impact on global climate regulation (€836,900), recreation (€1,264,924), flood regulation (€836,900).

61. Sahu, A, 2018. A methodology to modify land uses in a transit oriented development scenario. Available at: <https://shorturl.at/mivYt>

62. OECD, 2025. Global Compendium of Land Value Capture policies. Available at: <https://shorturl.at/9O8H7>

Establish green belts around OIZs

Implement green belts around planned OIZs in Karacabey and Nilüfer Districts to act as buffers for future residential growth.

RELEVANT THEMES

#landuse #industries #NBS #NCV

	Policy / regulation
	BMM Department of Zoning and Urbanisation BMM Department of Parks and Gardens
	Border of Karacabey /Nilüfer Districts
	New
	Medium (2-5 years)
	€ 250,000 Development/advisory costs € 0 Capital costs € 0 Operational costs (over 5 years)
	Direct Climate Resilience Direct GHG Emissions Indirect G&EI None Smart Direct NCV - €2,943,125 annual NCV impact
	None
	Land use – Per capita green space across each urban district is greater than 15 m ² .
	Industries – GHG emissions from energy and fuel use in industries are 40% lower than 2014.
	Climate & Environment – Tree canopy cover in each district is greater than 20%.
	3 – Good Health and Well-being 11 – Sustainable Cities and Communities 13 – Climate Action 15 – Life on Land

Industrial development has been the key driver of economic growth in Bursa, and since the establishment of the first OIZ in the 1960s has had a significant influence on urban growth. OIZs were typically set up in sparsely populated areas away from the urban core; however, as the city's population grew, new residential developments have grown around these OIZs. The proximity of residential and industrial areas has a negative impact on the quality of life for residents, primarily due to air and noise pollution because of industrial activity. The proximity of industrial and residential areas was identified as a priority challenge during consultation with stakeholders in Bursa.

Three OIZs are being developed in at the border of Karacabey/Nilüfer Districts (TEKNOSAB, TOSAB, and Deri OIZ), and BMM has an opportunity to proactively implement measures to minimise the impact of industrial activity on any future residential growth around these OIZs. **This action aims to implement a physical and environmental buffer through policy measures and land conversion around the three above mentioned OIZs to mitigate impacts of industrial activity on residential areas.**

COMPONENTS

1 ZONING REGULATION TO ESTABLISH A GREEN BELT AROUND OIZS

In collaboration with the Karacabey/Nilüfer District Municipality, BMM should look to enact zoning regulations that create a buffer from industrial land, by requiring specific uses within a defined distance from the boundaries of both OIZs. The regulation should look to preserve any open and green space already existing within this buffer (such as active agricultural plots or forested areas) and zone any undeveloped land parcels within the buffer as green, public space. The extent of the buffer can be determined through an assessment of existing land uses around the three OIZs, the potential area around them impacted by air and noise pollution (e.g., by studying the dominant wind direction in the area), potential high-growth areas for residential uses, outcome of environmental site assessments to detect contamination risks, and through consultation with current residents, academic and civil society representatives. A minimum 100-meter distance from the boundary of the OIZs should be zoned for this green belt – however, the depth of the buffer can vary depending on the specific conditions along the boundaries of the OIZs including size and shape of land

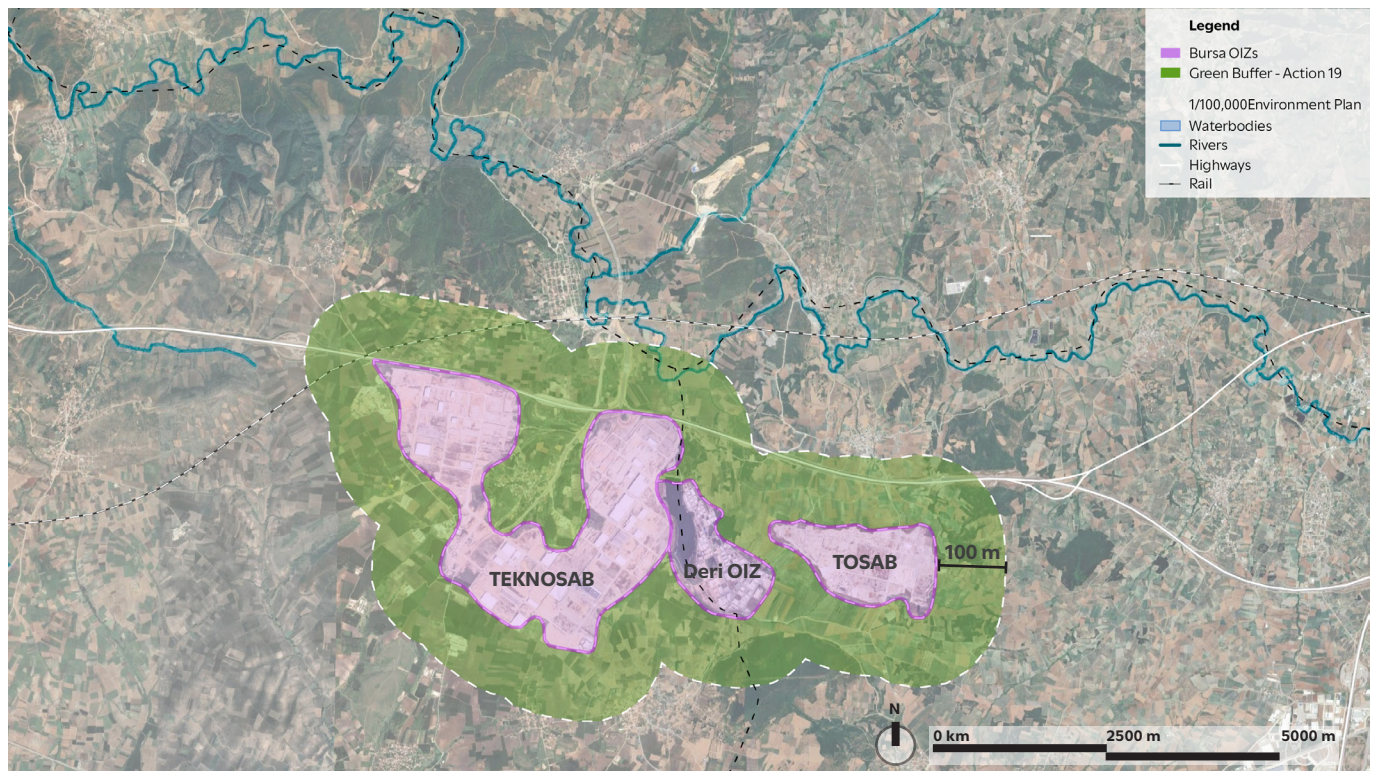


Figure B3: Map of existing green/open spaces around the developing OIZs on the border of Karacabey/Nilüfer District

Source: AtkinsRéalis analysis

parcels, proximity to transport corridors/hubs, proximity to natural assets like lakes or streams, or specific impacts identified by the technical assessment.

2 DEVELOPMENT INCENTIVES FOR VOLUNTARY GREEN SPACE PROVISION

A complementary incentive scheme should be introduced for land parcels near OIZs that cannot be zoned as part of the green belt. Based on certain eligibility criteria, the scheme can offer development incentives (e.g. New York's floor area ratio (FAR) bonuses for open space retention⁶³) to landowners and developers who voluntarily retain and maintain green public space in their landholdings that lie within the green belt around OIZs. Developers who preserve and maintain a specific size of public green space within the buffer could also be provided additional development rights on other land parcels within Karacabey/Nilüfer District. This approach will also encourage the application of market-based mechanisms to increase green space provision. These agreements should also take into account the need for long term maintenance of the green belt land to ensure these are well maintained and thrive for many years to come, this could include setting up agreements and delegating responsibility to the private sector. Such arrangements may involve the transfer of responsibility, in whole or in part, to the private sector.

3 DESIGN GUIDELINES FOR THE GREEN BELT

In addition to preserving and incentivising the creation of green open space around the OIZs, BMM should create design guidelines for increasing the effectiveness of the green belt. The guidelines should prescribe low-maintenance landscaping features that can further reduce the negative impacts of industrial activity on surrounding residential areas – for example, native trees with broad leaves and wide canopies or dense and tall shrubs can block noise from industrial activities, while trees with rough or waxy leaves can help filter particulate matter. These should also include considerations for safety and accessibility to ensure and future greenbelts are designed in an inclusive manner. Applying and implementing design guidelines could be incorporated within zoning regulations for the green belt or made a condition for receiving development incentives.

4 MONITORING AND EVALUATION

To test the effectiveness of the green belt, air quality and noise pollution should be regularly monitored within residential areas around both OIZs. Air quality and noise pollution monitoring should particularly look to identify any specific areas around OIZs where the green belt is not working as well as expected and outline any measures to address these gaps. Evaluation of the green belt around OIZs in Karacabey/Nilüfer District should also explore where similar policies should be scaled up across Bursa. Moreover, appropriate mechanisms for

maintenance of these green spaces should be explored and secured to ensure its quality and viability over a long time period; this could include setting up a private management contract or incorporating the green spaces within the green belt into BMMs Department of Parks and Gardens current management remit.

TIMELINES

0–6 MONTHS

Assess areas around OIZs – this will involve mapping land parcels and ownership, current land uses, likely residential expansion corridors, soil assessments to detect contamination risks, and areas likely to be impacted by air and noise pollution around the three OIZs.

0–6 MONTHS

Develop design, remediation, and maintenance guidelines for the green belt – this can be carried out in parallel to the assessment around OIZs.

6-12 MONTHS

Demarcate green belt and draft appropriate zoning regulations – based on the assessment of the areas around the green belt, demarcate a proposed green belt, outline zoning regulations, and formulate development incentives. Carry out on the draft regulation and design guidelines to obtain buy-in before the regulation is taken ahead for council approval.

12-15 MONTHS

Adoption of zoning regulations – based on stakeholder consultation, update and finalise zoning regulations, and the policy framework for development incentives.

15+ MONTHS

Monitoring and evaluation – regularly monitor air and noise pollution metrics and compliance with zoning regulations. In parallel, document land cover changes and resident feedback to assess results from establishing the green belt to inform future expansion. This should also include management of the green spaces to ensure its quality and viability over a long-time period.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Land ownership may increase complexity in coordination, and early engagement will be essential to ensure coherence.
- Limited land purchase may be required to maintain green belt continuity, and should be budgeted accordingly.



KEY STAKEHOLDERS

- **BMM Department of Zoning and Urbanisation** – Implementing Agency – All components and steps.
- **BMM Department of Urban Transformation** – Involve and Collaborate – All components and steps
- **BMM Department of Parks and Gardens** – Implementing Agency – All components and steps.
- **Karacabey/Nilüfer District Municipalities** – Involve and Collaborate – All components and steps.
- **OIZ Management** – Inform and Consult – Steps 2 and 3
- **Landowners and Developers** – Inform and Consult – Steps 2 and 3



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Sources** – BMM budget associated with implementing planning policy and regulation.
- **Grants** – National government, IFIs (for project preparation) and development organisations.
- **Private sector** – Potential funding from OIZ management and tenants through green infrastructure levies or FAR bonuses.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

No direct revenue generation or cost saving opportunities as a result of this action.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The improvement of public space quality and air quality near residential uses will benefit traditionally underserved and vulnerable groups, and improve economic inclusion through enhanced health benefits. Opportunities for maintenance of green spaces should be provided for companies owned or run by women or disadvantaged groups where possible. Any design of green spaces should consider accessibility and safety for all.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Increasing the amount of green space in Karacabey/Nilüfer Districts will drive multiple ecosystem benefits. Creating a buffer around the OIZs will reduce the impact of air pollution on nearby land uses, absorb stormwater runoff and provide flood alleviation, and mitigating extreme heat adjacent to industrial zones.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – While the extent of the impact cannot be calculated at this stage of action development, this action is expected to contribute to GHG emissions reductions as a result of carbon sequestration by trees and plants as part of the green belts around OIZs.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

No benefits.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – Protecting land uses such as forested areas and designated green spaces will lead to enhanced vegetative cover and generate benefits for local climate regulation, flood regulation, air pollutant removal, water quality regulation, and recreation services. The incentive scheme for green space provision will have direct recreation and health and wellbeing benefits for visitors. The Green Belt will also have wider benefits to surrounding land areas/residential areas by providing indirect air pollutant removal and air quality improvements.

Estimated annual NCV impact: €2,943,125

Ecosystem service impacts estimated using 'bottom-up' approach. This action is likely to have positive impact on global climate regulation (€7,084,090), recreation (€4,540,229), flood regulation (€86,094), and crop provisioning (n/a).

63. The City of New York (2011). 78-33 | Zoning Resolution. [online] Nyc.gov. Available at: <https://zr.planning.nyc.gov/article-vii/chapter-8/78-33> [Accessed 17 Jun. 2025].

Transform existing industrial area in Kestel or Gürsu Districts

Relocate existing industrial facilities away from residential neighbourhoods in Kestel or Gürsu districts and convert the vacated land into green space and social infrastructure.

RELEVANT THEMES

#landuse #industries #NBS #NCV #G&EI

	Capital Investment (Project)
	BMM Department of Zoning and Urbanization BMM Department of Urban Transformation
	Kestel or Gürsu
	New
	Long (>5 years)
	€ 600,000 Development/advisory costs € 24,000,000 Capital costs € 1,050,000 Operational costs (over 5 years)
	Direct Climate Resilience Direct GHG Emissions Direct G&EI None Smart Direct NCV - €1,059,537 annual NCV impact
	None
	Land use – Per capita green space across each urban district is greater than 15 m ² . Land use – 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip). Climate & Environment – Tree canopy cover in each district is greater than 20%.
	5 – Gender Equality 11 – Sustainable Cities and Communities 13 – Climate Action 15 – Life on Land

The eastern urban districts of Bursa – particularly Kestel and Gürsu – face a deficit of green spaces and limited access to community infrastructure, contributing to reduced quality of life. The two districts also contain industrial land uses which are increasingly incompatible with adjacent residential neighbourhoods. **Drawing on the success of the Merinos Park redevelopment, this action proposes the regeneration of strategically located industrial areas within Kestel and Gürsu districts to create a publicly accessible green space and establish new social infrastructure such as community centres, sports facilities and cultural amenities.** The action supports urban greening while minimising disruption to economic activity through incentivised relocation and reuse of under-capacity OIZs.

COMPONENTS

1 IDENTIFICATION OF SUITABLE INDUSTRIAL AREA AND RELOCATION SUPPORT PROGRAMME

This component will identify a suitable industrial area for regeneration and enable a structured and supported relocation of industrial units currently occupying the regeneration site to underutilised OIZs.

- **Conduct industrial mapping and spatial analysis across Kestel and Gürsu districts to identify candidate regeneration sites:** The assessment should consider proximity to residential areas, potential for land assembly, and current land ownership patterns. The willingness to relocate for industrial units located within the potential regeneration sites should also be ascertained by engaging industrial unit owners through focus groups and interviews, or by engaging a representative group of industries.
- **Assess nearby OIZs with available capacity:** Three OIZs within Kestel district – Kestel OIZ, Barafakih OIZ, and Uludağ OIZ – appear to have occupancy rates below 85% and may have suitable land parcels for relocated industrial units. An assessment of available land parcels, infrastructure capacity and suitability for relocated industrial units should be carried out to determine suitability.
- **Develop incentives for relocation to industrial units:** Incentives for relocation could primarily take the form of financial support such as fixed-term subsidised rents, grants or soft loans to support physical relocation and fit-out of new premises, or payments to cover temporary

loss of income. As part of relocation, incentives could also be offered in the form of technical advice for more efficient or sustainable operations, financial support for upgrading equipment or machinery, and administrative and permitting support to expedite the transition.

- **Facilitate transparent engagement with industrial tenants:** Transparent communication and regular engagement with industrial owners throughout the process is essential to build trust. There should be regular information sessions, one-to-one consultations, and relocation workshops conducted throughout the process. Industrial unit owners must be provided options for OIZ plots aligned with operational needs, sector capability and timelines. Participation in the relocation programme should be formalised through signed relocation agreements.

2 TRANSFORMATION PLANNING AND IMPLEMENTATION

Once relocation of industries begin, this component will transform the vacated site into accessible, climate-resilient green space and inclusive social infrastructure.

- **Confirm ownership status and initiate acquisition or negotiation** with public and private stakeholders to consolidate the transformation area under unified control.
- **Form a Transformation Steering Committee** with BMM, district municipality, and OIZ reps for coordination, approvals, and budget oversight.
- **Engage the community** to identify priority uses, heritage assets, connectivity needs, and public space functions. Use insights to shape a draft design and deliverable brief for the transformation vision.
- **Commission an integrated regeneration masterplan**, covering green spaces, community facilities, mobility upgrades, phasing, design guidelines, and sustainability standards.
- **Conduct environmental assessments** to identify contamination and implement appropriate remediation (e.g. soil removal, capping, phytoremediation⁶⁴).
- **Deliver phased redevelopment** with key public space upgrades, tracking usage, satisfaction, and environmental impact.

TIMELINES

0-9 MONTHS

Conduct district-wide assessments to select a transformation site and evaluate relocation potential of nearby OIZs

6-12 MONTHS

Set up a steering committee, design relocation support, and engage industrial tenants at the regeneration site.

12-24 MONTHS

Secure control of land parcels, complete environmental site assessments, alongside the remediation strategy.

18-36 MONTHS

Develop a transformation project brief and design masterplan through consultation.

36+ MONTHS

Begin site remediation, infrastructure works, and phased relocation of businesses.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Voluntary relocation depends on a well-structured support package** and early engagement with affected business.
- **Soil and water contamination assessments are essential, particularly for sites with chemical, textile, or metal infrastructures.** Where risks are present, remediation must comply with national environmental standards.



KEY STAKEHOLDERS

- **BMM Departments of Zoning and Urbanization** – Implementing Agency – All components and steps
- **BMM Department of Urban Transformation** – Implementing Agency – All components and steps
- **BMM Department of Parks and Gardens** – Involve and Consult – All components and steps
- **Provincial Directorate of Industry and Technology** – Consult and Collaborate – All components and steps
- **District Municipalities** – Inform and Consult – All components, steps 1-2 and 4-6
- **OIZ Management authorities** – Consult and Collaborate – Component 1
- **BTSO** – Consult and Collaborate – Component 1
- **Industrial tenants and landowners** – Consult and Collaborate – Component 1



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own source** – BMM budgets assigned to the Department of Parks and Gardens for developing green spaces.
- **Grants** – National government, IFIs (for project preparation) and development organisations.
- **Leverage land value capture mechanisms** - through uplift in surrounding property values



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

No direct revenue generation or cost saving opportunities as a result of this action.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Relocating industries to underutilised OIZs and transforming the left behind vacant sites and buildings into green spaces, social and community facilities will improve residents' access to high-quality public green spaces and social services in underserved areas, particularly for women, youth, and lower-income residents, while promoting local employment.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Replacing polluting industrial uses within residential neighbourhoods with green spaces can contribute to flood alleviation and improving stormwater retention and will help mitigate the impacts of extreme heat.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – While not quantifiable at this stage of action development, this action is expected to have significant GHG emissions reduction potential. Through the application of a low-carbon approach in design, construction and operations, embodied carbon can be reduced. Planting trees and incorporating NbS as part of the action will enable carbon sequestration.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

No benefits.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – By transforming industrial sites into multi-functional and high value green spaces and social and community facilities, the value of recreational and health and wellbeing services will be enhanced. Some urban greening measures may also deliver global climate regulation and flood regulation services as well.

Estimated annual NCV impact: €1,059,537

Ecosystem service impacts estimated using 'bottom-up' approach. This action is likely to have positive impacts global climate regulation (€382,321), recreation (€577,855), and flood regulation (€99,361).

64. Phytoremediation is the process of using green plants to environmentally remediate contaminated soil, water, and air.



Gölyazı, Nilüfer

Buildings

06

Develop a digital database for buildings

07

Enhance structural integrity and energy efficiency in new and existing buildings

08

Implement sustainability and resilience interventions in BMM-owned buildings

09

Deploy a low-emissions heating programme for residential buildings





Develop a digital database for buildings

Establish a centralised digital database that consolidates data on building resilience and energy efficiency.

RELEVANT THEMES

#buildings

#energy

#digital



Capital Investment (Project)
Data / Monitoring System



BMM Department of IT
District Municipalities



Bursa-wide



Ongoing



Short (<2 years)



€ 0	Development/advisory costs
€ 1,165,000	Capital costs
€ 50,000	Operational costs (over 5 years)

Direct

Climate Resilience

Indirect

GHG Emissions

Indirect

G&EI

Direct

Smart

None

NCV



ACTION 7

Enhance structural integrity and energy efficiency in new and existing buildings



ACTION 9

Deploy a low-emissions heating programme for residential buildings

ACTION 21

Increase capacity within the Energy Efficiency Centre



Buildings – More than 50% of commercial and residential buildings have Energy Performance Certificates.



11 – Sustainable Cities and Communities

The Buildings sector is one of the largest contributors to greenhouse gas (GHG) emissions in Bursa, comprising over 30% of total emissions as of 2020. It is also a sector with high vulnerability to seismic risk, owing to an ageing building stock and high concentrations of non-compliant construction in some neighbourhoods. However, a precise understanding of challenges related to sustainability and resilience within this sector is impeded by the lack of consolidated and consistent data on the building stock. The lack of comprehensive and standardised data particularly affects efforts to transition to more sustainable heating and energy systems, as well as the ability to monitor and reduce GHG emissions from residential and commercial buildings. Availability of data on the building stock was also identified as a priority challenge by stakeholders during consultations.

This action looks to develop a Digital Building and Energy Performance Database to enable better coordination, monitoring, and policy development.

The database will serve as the foundation for decision-making, enabling evidence-based prioritisation of retrofitting programmes, enforcement of energy performance standards, and targeting of financial incentives for low-carbon upgrades.

A key element of this initiative involves consolidating and digitising existing building and energy data held across multiple entities, including district municipalities, BMM departments, energy providers and private developers. The action also looks to commission targeted studies to address critical data gaps on energy performance and seismic risk and scale up the city-wide smart meter programme to improve real-time energy monitoring and management.

COMPONENTS

1 DATABASE OWNERSHIP AND OPERATIONAL PROTOCOL

The BMM Department of IT would be the most suitable lead operational agency for the database. As a critical first step, it should establish a governance framework for the Database that outlines roles and responsibilities, data update and management processes, sharing and access mechanisms, and regulatory measures to promote consistent usage across departments. Protocols for data management

and usage should be developed, taking into consideration any requirements under national data protection and privacy regulations.

2 BUILDINGS INFORMATION TEMPLATE (BIT)

The Database should be designed for future and existing compatibility with digital permitting systems and zoning platforms, achieved through developing a unified data template in consultation with relevant authorities. The Building Information Template (BIT) should define required building attributes to enable action on sustainability and resilience such as floor area, typology, age, use class, EPC rating, construction materials, structural systems, and conformance to seismic code. A key element of developing the BIT should be a review of the information required by District Municipalities to issue building permits, as most of this information may already be requested or available within permits.

3 ASSESS EXISTING DATA SOURCES, ADDRESS DATA GAPS

Several different entities within Bursa may already hold data relevant to the BIT. These existing datasets from national, municipal, and utility sources (electricity, water, natural gas, etc.) should be compiled and assessed for completion, reliability, and accuracy against the BIT. Where there are data gaps or data from existing sources is assessed to be of low quality or not up to date, targeted studies should be conducted to fill key information gaps.

4 ROLLOUT OF CITY-WIDE SMART METER PROGRAMME

The installation of smart meters in all buildings will assist in addressing data gaps around energy consumption and efficiency. Smart meters could be rolled out in a phased manner, starting with around 5,000 smart meters to be installed across BMM-owned buildings, and followed by high-consumption public and industrial buildings and other private buildings (including, residential, commercial and industrial). It will include the installation of advanced metering infrastructure (AMI) to enable real-time energy monitoring, efficient billing, and improved energy management. This component should be delivered in collaboration with UEDAS, the entity responsible for electricity distribution in the city.

5 DIGITAL BUILDING DATABASE AND MANAGEMENT SYSTEM (DBDMS)

This component focuses on developing both the front-end interface and the underlying DBDMS that will store and process building information. It should be designed to handle large-scale data whilst enabling cross-referencing with GIS layers, and compatible with other digital tools. It should also include basic analytics and reporting functions to support evidence-based decision-making across departments. Key activities within this component include:

- **Initial design and testing** of the DBDMS architecture, ensuring it meets scalability, accessibility, and security requirements.
- **Integration of existing data layers** from Component 3, and aligning with existing municipal IT infrastructure.
- **Development of a web-based user interface** for users to view, search and update records.
- **Embedding of basic analytics** tool to support functions such as energy benchmarking, retrofit target, and risk profiling.
- **Piloting the full system in a select district**, collecting feedback, and refining functionalities before city-wide rollout.
- **Provide capacity training** for relevant municipal staff on using and maintaining the database, including where possible focusing on women and disadvantaged individuals to ensure equal participation in opportunities for upskilling employees.

TIMELINES

0–6 MONTHS

Establish ownership, designate responsible entities, and draft operational protocols.

6–12 MONTHS

Develop the BIT through technical and stakeholder consultations.

12–18 MONTHS

Collect existing datasets from different authorities and energy providers, standardise and integrate them into the established database. Where data gaps exist, commission studies and enable a phased rollout of smart meters to fill these gaps.

18–30 MONTHS

Design and test the database platform, including spatial visualisation and basic analytics features and deploy the database city-wide, provide capacity training to district municipalities and operationalise long-term maintenance mechanisms.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **The database must comply with national data protection laws⁶⁵ and best practices**, ensuring responsible data handling and restricted access where necessary.
- **Consistent collaboration between municipalities, energy providers and regulators** is essential for effective data integration and governance.
- **Need for scalability and future integration** within the database design, to allow room for expansion and integration with future sustainability initiatives.



KEY STAKEHOLDERS

- **BMM Department of IT**- Implementing Agency – All Components and Steps
- **District Municipalities** – Implementation Agency – All Components and Steps.
- **BMM Department of Zoning and Urbanisation** – Consult and collaborate – All Components and Steps
- **Ministry of Environment Urbanisation and Climate Change** - Consult and Collaborate – All Components and Steps.
- **Universities, academics and researchers** – Involve and collaborate – Steps 1-4
- **Department of Real Estate and Expropriation** – Involve and collaborate – Components 2, 3 and 5 and Steps 3 and 4.
- **UEDAS** – Involve and collaborate – Component 4.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to digital innovation and data management.
- **Grant** – National government, IFIs (for project preparation) and development organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

There are opportunities for paid Application Programming Interface (API) integration for Third-Party Services, where energy service providers and private stakeholders could pay for API access to integrate the database's insights into their platforms for energy monitoring, retrofit financing, or real estate valuations.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Developing a digital database for building-level information will help to identify which buildings and potentially low-income households should be targeted for support through programmes such as the one proposed in Action 9. Moreover, deploying smart meters in residential buildings will help people understand their energy use and potentially lower energy bills. For implementation of smart meters, capacity building measures to ensure greater workforce participation from women and disadvantaged individuals should be implemented.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The dashboard can support disaster resilience planning by providing authorities with building integrity data to prioritise reconstruction efforts in case of seismic events. Additionally, the system will help optimise demand-side energy management, reducing grid stress and ensuring a more stable energy supply in extreme weather conditions.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – The integration of real-time building performance data will enhance energy efficiency monitoring, enabling targeted interventions to reduce GHG emissions and transition to sustainable heating systems. By identifying inefficient buildings, the database will support retrofit funding allocation, accelerating decarbonisation efforts in the built environment.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action will significantly advance the city's smart maturity, strengthening its capacity for data-driven energy management, urban planning, and climate resilience. It may enable predictive analytics to identify inefficiencies and support evidence-based retrofitting strategies. Ensuring interoperability with existing municipal and energy systems will be key, allowing seamless data exchange and automated compliance monitoring. Additionally, robust data governance and privacy measures will be essential, particularly given the integration of live energy consumption data, requiring clear access controls and compliance with national data protection laws. To maximise impact, the dashboard should be designed with accessibility in mind.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.

65. Law on the Protection of Personal Data No. 6698 dated April 7, 2016 (LPPD)



Koza Han, Osmangazi

Enhance structural integrity and energy efficiency in new and existing buildings

Implement enhanced audit regime and incentivise retrofitting of older buildings for compliance with seismic and energy efficiency codes.

RELEVANT THEMES

#buildings

#energy

#digital

#energyefficiency

#resilience



Policy / regulation

Capacity-building / Awareness Programme



BMM Department of Zoning and Urbanisation



Bursa-wide



Ongoing



Medium (2-5 years)



€ 3,750,000 Development/advisory costs

€ 0 Capital costs

€ 0 Operational costs (over 5 years)

Direct

Climate Resilience

Indirect

GHG Emissions

Indirect

G&EI

Direct

Smart

None

NCV



ACTION 6

Develop a digital database for buildings



Buildings – More than 50% of commercial and residential buildings have Energy Performance Certificates.



3 – Good health and well-being

7 – Affordable and Clean Energy

11 – Sustainable cities and communities

13 – Climate Action

The regulatory framework for monitoring building safety, sustainability and energy efficiency at the national and local levels is quite robust; however, as highlighted during consultations with Bursa stakeholders, there are significant gaps in compliance with these regulations.

Approximately 75% of the building stock was constructed before 2000, well before the 2007 and 2018 updates to building codes that incorporated enhanced measures for seismic risk. Similarly, most of the building stock is not subject to the minimum standards of energy efficiency required under the Energy Performance Regulations in Buildings (2008) and the Energy Efficiency Law (2007), or the requirement for all new constructions after 2011 to obtain an Energy Performance Certificate (EPC) with a class C performance rating.

For new buildings, building permits are issued only after demonstrating compliance with plans with existing regulations; however, there is limited capacity to monitor and enforce compliance with the issued building permits. There is also limited capacity to monitor additions or alterations to existing buildings, resulting in a significant stock of buildings where structural integrity and safety may have been compromised.

This action seeks to **strengthen regulatory enforcement by introducing mandatory audits at key construction phases for new developments and introducing incentives for ensuring compliance with safety and sustainability regulations in pre-2011 buildings.**

COMPONENTS

1 ENHANCED COMPLIANCE MECHANISMS FOR NEW CONSTRUCTIONS

For all new developments, mandatory audits for structural safety and energy efficiency in line with the issued building permits should be introduced at the following stages:

- **Post-structural framing**, ensuring design-stage energy performance ratings and proposed structural measures to mitigate seismic risk have been implemented;
- **Pre-installation of energy systems** (HVAC, insulation, double glazing), ensuring energy-saving features are installed and operational prior to final EPC;

- **Final pre-occupancy inspection**, confirming that the targeted performance rating in the EPC certificate is being achieved, and all seismic and fire safety measures in accordance with regulation have been implemented; and
- **Post-occupancy inspection**, carried out at 10-year intervals after the occupancy inspection to assess any changes in building energy performance or structural integrity. An EPC certificate is valid for 10 years after issuance, thus providing an opportunity to combine renewal of the certificate with a post-occupancy assessment.

These audits will verify compliance with Class C or higher EPC standards and ensure the integration of approved energy-efficient design elements throughout the construction process. It provides a document audit trail of energy efficiency integration and prevents performance gaps, aligning with the EU's Energy Performance of Building Directive (EPBD) (Directive (EU) 2024/1275) requirement for reliability and comparability. Mandatory audits could utilise the Building Information Template described under Action 6, and data from each audit uploaded to the digital database for buildings to enable the availability of accurate and up-to-date data on the building stock.

2 INCENTIVE PROGRAMME FOR EXISTING BUILDINGS

To address the large proportion of existing buildings that do not meet energy efficiency standards or are compliant with current seismic codes, this component introduces an incentive scheme encouraging voluntary energy efficiency upgrades, climate resilience measures, and structural integrity retrofits. Incentives for owners of pre-2011 buildings who achieve improved EPC ratings could include council and property tax reductions, fast-track permit processing for building upgrades, or subsidies and grants for audits and retrofits. The most appropriate incentive and implementation mechanism should be explored during the first steps of developing the programme. Similar incentives could be extended to buildings built before 2007 to implement structural integrity retrofits such as bracing or strengthening walls, strengthening foundations, or reinforcing non-structural components (e.g. partitions, windows).

The programme could be initiated in Districts with a high proportion of ageing building stock or a high prevalence of non-compliant construction – for

example, during the consultation, stakeholders identified Osmangazi and Yıldırım districts as having high concentrations of non-compliant buildings.

TIMELINES

0–6 MONTHS

Define audit protocols, compliance checkpoints, and performance verification criteria in consultation with the Ministry of Environment, Urbanisation and Climate Change (MoEUCC), and technical experts from academia, private sector and civil society groups in Bursa.

0–9 MONTHS

Design the incentive programme for existing pre-2011 buildings, including assessment and eligibility criteria, financial incentive mechanisms, and governance processes.

6–12 MONTHS

Amend municipal construction permitting procedures to include mandatory energy audits at the three designated phases for all new developments.

Launch targeted stakeholder engagement and public awareness campaigns on the new requirements and available incentives.

12–18 MONTHS

Develop an information management system to register energy audits, monitor results, and integrate audit data with the EPC database and building permit records (Action 6).

12–48 MONTHS

Begin phased implementation of the energy audits for new buildings, and initiate pilot in Osmangazi and Yıldırım districts.

Monitor energy audit compliance rates, EPC ratings for new and retrofitted buildings, and user feedback.

48+ MONTHS

Review pilot results, adapt and scale up programme across Bursa.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Additional training and certification** may be required to expand the pool of qualified energy auditors and ensure quality control.
- **Audit data must be integrated into existing EPC and permitting databases** to enable accurate tracking and transparency.
- **Implementation costs for audits must be balanced with potential savings** to homeowners and developers, whilst ensuring the incentive mechanisms are fiscally sustainable.
- **Establish collaborative relationship with MoEUCC (Step 1)** at project onset to ensure alignment on enforcement of EPC regulations and audits.



KEY STAKEHOLDERS

- **BMM Department of Zoning and Urbanisation** – Implementing Agency – All Components and Steps.
- **Ministry of Environment Urbanisation and Climate Change** – Involve and collaborate – All Components and Steps.
- **Building Inspection Companies** – collaborate – All components and steps
- **District Municipalities** – Involve and Collaborate – All Components and Steps.
- **Bursa Chamber of Engineers** – Consult – All components.
- **Local residents and building owners** – Inform and Consult – All Components.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budgets associated with building maintenance.
- **Grant** – National government, IFIs (for project preparation) and development organisations, for example, EU IPA III funding.
- **Loans** – Ilbank, IFIs, and commercial banks.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES

✓ Yes

Potential revenue streams include, audit registration fees, expedited permit processing fees for compliant developments, and increased tax revenue from potential increase in property values.

BURSA

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Component 2 offers benefits towards the reduction of energy poverty. It will lower utility costs for households, particularly benefiting low-income and vulnerable groups who often reside in older, inefficient buildings. It also supports job creation in energy auditing, construction, and retrofit services. The programme is also expected to have indirect health benefits, as modern and more efficient heating devices may also improve indoor air quality.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Improving building envelopes will enhance thermal comfort, reduce exposure to extreme temperatures, and increase resilience to heat waves and energy system disruptions. Retrofitting existing buildings to align with the 01.01.2019 Türkiye building code will reduce the risk of damage from earthquakes.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – By improving compliance with energy efficiency standards, and enabling energy-related retrofits in older buildings, the action will help to indirectly reduce operational energy demand and associated emissions from the building sector, which is currently the second largest emitter in Bursa.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action includes the integration of energy audit data with digital permitting systems and EPC databases enabling performance tracking, data analytics, and AI-assisted compliance forecasting.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.



Cumalıkızık Village, Yildirim

Implement sustainability and resilience interventions in BMM-owned buildings

Retrofit BMM-owned buildings to improve energy efficiency and serve as Resilience Hubs.

RELEVANT THEMES

#buildings

#energy

#energyefficiency

#resilience

#mitigation

#NBS

#NCV

#G&EI



Capital Investment (Project)



BMM Department of Public Works



Bursa-wide



New and Ongoing



Medium (2-5 years)



€ 400,000 Development/advisory costs
 € 4,150,000 Capital costs
 € 415,000 Operational costs (over 5 years)

Direct

Climate Resilience

Direct

GHG Emissions - 31,100 tCO₂e/year

Direct

G&EI

Direct

Smart

Direct

NCV - €70,636 annual NCV impact

**ACTION 21**

Increase capacity within the Energy Efficiency Centre



Buildings – Energy efficiency of municipal buildings is 30% higher than 2024.

Climate & Environment – Tree canopy cover in each district is greater than 20%.



5 – Gender Equality

7 – Affordable and Clean Energy

11 – Sustainable Cities and Communities

12 – Responsible Consumption and Production

13 – Climate Action

BMM owns and operates a portfolio of buildings across the metropolitan region that can serve as exemplars for implementing low-emissions energy solutions and urban resilience. This action looks to implement a range of measures across the BMM-owned building portfolio, with a pilot phase of around 100 buildings, to mainstream energy efficiency and low-emissions energy measures and to create Resilience Hubs that help Bursa's residents combat extreme heat. BMM already has experience in developing buildings to reach high sustainability standards, as shown by a BMM New Service Building which achieved the BREEAM In-Use-Certificate; lessons learned from developing this building should be applied to the rest of the building's stock.

COMPONENTS

1 RETROFIT BUILDINGS WITH LOW-EMISSION ENERGY SOLUTIONS

As a starting point for more sustainable operations, BMM can look to implement solutions to reduce electricity consumption and improve energy efficiency. A foundational step is to evaluate the current energy performance of all municipal buildings and develop a strategy to improve efficiency. This will entail the following sub-components:

- **Conduct energy audits on all municipal BMM-owned buildings** to produce a prioritised inventory for intervention. As highlighted by the 2022 BUSECAP Monitoring and Evaluation Report, GHG emissions from electricity consumption in BMM-owned buildings and facilities have increased by 131% between 2014 and 2020. The energy audit should identify building types and uses with the highest energy demand, and prioritise low-performing buildings based on use, size, and public service role. Within low-performing buildings, the audit should identify the causes of inefficiency such as poor insulation, inefficient lighting or electrical fixtures, outdated heating, ventilation and air conditioning (HVAC) systems, or unmanaged standby loads.
- **Commission a technical study to develop a suite of effective retrofit options and interventions** tailored to building type, age, and use. Determine detailed costs, delivery phasing, and indicative emissions reduction potential from each intervention option. This could include: installing cavity walls and increasing wall and roof insulation, replacing old windows with double glazing, replacing fittings and equipment with energy-efficient devices, implementing LED lighting and smart sensors, and replacing HVAC systems or draught-proofing doors and windows.

- **Procure retrofitting contractors through a competitive, transparent process that evaluates not only cost and technical capacity, but also social and environmental value (including gender and economic inclusion, workplace safety and labour conditions).** Selection criteria should prioritise contractors with demonstrated experience in energy-efficient retrofitting of public buildings, as well as those able to incorporate local, low-emissions materials and energy-efficient technologies.

As a pilot, assuming the instillation of insulation on 100 BMM buildings with an average size of 5,000m² at an average cost of EUR 5,000 to insulate 1,000m², would result in total costs of around EUR 2,600,000⁶⁶.

2 IMPLEMENT RENEWABLE ENERGY GENERATION MEASURES

This component introduces on-site renewable energy generation in BMM buildings, reducing grid dependence and contributing to long-term cost and emissions savings. It should include the following sub-components:

- **Conduct a technical feasibility study to identify suitable rooftops for solar PV within the municipal building stock,** considering structural integrity, orientation, shading, and potential to connect to the grid, if allowable for municipal buildings.
- **Develop a standard package of solar and energy storage interventions** with detailed costs, projected savings, and emissions reductions per installation. Simultaneously, set the performance benchmarks, cost ceilings, and annual roll-out targets across building categories as a part of the package.
- **Engage local manufacturers and installers to procure installation services,** this could also include developing training and certification programmes to ensure long-term capacity.

As a pilot, assuming the instillation of 20kW solar array on 100 BMM buildings at an average cost of EUR 9,000 each, would result in a total cost of around EUR 900,000⁶⁷.

3 IMPLEMENT RESILIENCE HUBS

This component supports the transformation of municipal buildings, particularly those with adjacent courtyards, gardens, or forecourts as green open spaces that can serve as shelters during extreme heat events. Inspired by the Paris Oasis Schoolyards Programme⁶⁸, these green spaces will help address local urban heat island effects, as well as also offer shaded and safe areas during heatwaves.

The component will entail design interventions that convert hardscaped or underused grounds into multifunctional, green resilience spaces, these may include:

- **Shaded outdoor areas** for cooling and community gatherings;
- **Sustainable Urban Drainage Systems (SuDS) and NbS,** including, permeable surfaces, community gardens, and rain gardens to reduce runoff and support infiltration; and
- **Water harvesting and reuse systems,** with educational and recreational reuse (e.g. gardens, cooling features).

Community engagement and education should be a core element of this component, ensuring residents and users are part of the planning and activation of these spaces, promoting long-term use and resilience awareness.

As a pilot, assuming 100 resilience hubs are established at BMM buildings with an individual cost of around EUR 6,500 based on costs associated with the Paris Oasis Schoolyard Program, would result in a total cost of around EUR 650,000⁶⁹.

TIMELINES

0–9 MONTHS

Identify a menu of interventions and opportunities for low-emissions energy solutions, renewable energy and Resilience Hubs. This should include outline costs, implementation and delivery mechanisms, benefits and GHG emissions savings etc.

9–18 MONTHS

Assess the municipal buildings stock to identify which buildings to benefit from the interventions. This should include undertaking energy efficiency audits, rooftop assessments to identify renewable energy potential, and site identification for Resilience Hubs.

18–30 MONTHS

Design site-specific intervention plans, using the information gathered from steps 1 and 2 begin the detailed design and due diligence for implementation of interventions at selected buildings, this should also include procurement of services and obtaining any necessary construction permits.

30+ MONTHS

Begin implementation of identified interventions.



Figure B4: Images Paris Oasis School yard

Source: © Ville de Paris - Laurent Bourgogne, and CAUE de Paris.



IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **The availability and approved list of suitable equipment** should be determined beforehand.
- **Following the Bursa Girls High School pilot**, license and permit applications for rooftop solar systems should be submitted early to the electricity authority to avoid delays. The procedure for obtaining the necessary permits should be initiated prior to purchase.
- **Retrofit works must be scheduled to avoid service disruption**, especially in operational schools and health facilities, this should be accompanied by stakeholder engagement.



KEY STAKEHOLDERS

- **BMM Department of Public Works** – Implementing Agency – All Components and Steps.
- **BMM Department of Real Estate and Expropriation** – Consult and Collaborate – All components and steps
- **BMM Department of Parks and Gardens** – Involve and Collaborate– Component 3
- **Ministry of Environment, Urbanization and Climate Change (MoEUCC)** – Consult and Collaborate – All Components and Steps.
- **District Municipalities** – Inform and Consult – All Components and Steps.
- **Energy Service Companies** – Collaborate - Components 1&2.
- **Building Users** – Inform and Consult - Components 1&3.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budgets associated with building upgrades and maintenance.
- **Grants** – National government, MoEUCC, IFIs (for project preparation) and development organisations, for example,

the World Bank through the KABEV programme.

- **Loans** – Ilbank, IFIs, and commercial banks.
- **Climate Finance** – For example, the Climate Finance Acceleration or Climate Investment Fund.
- **Energy performance contract** – potential to explore ESCOs to finance the operation of an energy system by providing a savings guarantee.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Potential for revenue generation opportunities from the sale of renewable energy back to the electricity grid and cost savings associated with lower energy use.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action creates opportunities for local employment in energy audits. Further considerations for upskilling of women and disadvantaged groups in Bursa should be given to ensure equitable job opportunities. Moreover, by prioritising community buildings, benefits for underserved and vulnerable groups who may disproportionately rely on public services can be achieved. The inclusive design of Resilience Hubs ensures safe, accessible public space.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Building retrofits and the installation of clean energy systems increases operational resilience and reduces reliance on fossil fuels and grid electricity. The action also offers opportunities to enhance the buildings' resilience to seismic risks.

Resilience Hubs integrated into open spaces reduce the risk of heat stress, strengthen heat resilience, and offer the opportunity to capitalise on other ecosystem benefits such as flood alleviation.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – By improving energy performance in existing buildings and on-site renewable energy generation, this action will directly offset grid-based emissions. Over time, the cumulative savings will contribute to Bursa's climate targets and serve as a model for replication. GHG emissions reductions have been calculated as an assumed 30% reduction of total GHG emissions from Municipal building energy and fuel use from 2020.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Energy monitoring systems that allow real-time tracking of energy consumption, emission, and system performance included in this action will be integrated within the creation of a digital database for buildings (Action 6), thus supporting predictive maintenance, adaptive management, and evidence-based policy.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – The implementation of renewable energy generation measures (e.g. solar PV) will contribute to the renewable energy ecosystem service. Implementing Resilience Hubs, particularly with gardens and green open spaces will deliver local climate regulation by addressing the urban heat island effects. Implementing SuDS such as community gardens and rain gardens will improve the flood regulation service in an urban context. Educational and recreational use of the Resilience Hubs and green spaces will improve the recreation, health and wellbeing, and education services.

Estimated annual NCV impact: €70,636

Ecosystem service impacts estimated using 'bottom-up' approach. This action is likely to have positive impacts on global climate regulation (€25,488), recreation (€38,524), and flood regulation (€6,624).

66. Cost of insulating 1,000m² building was around TRY 40,000 in 2020, accounting for inflation this would be around TRY230,000 in 2025, based on information from: Thermolock, 2020, Thermal Insulation Provides Under-Invoicing, Available at: <https://thermolock.com/en/media/blog/thermal-insulation-provides-under-invoicing>.

67. Cost based on average costs of Three Phase Plus 20 kW Solar Power Price (On-Grid) being \$10,180 which is around € 9,000, based on information from: cw-enerji, 2025, Solar Panel Price for a House | Installation and Calculation (2025), Available at: <https://cw-enerji.com/en/cw-enerji-library/solar-panel-price-for-a-house-installation-and-calculation-24>.

68. Climate ADAPT (2022). Paris Oasis Schoolyard Programme, France — English. [online] climate-adapt.eea.europa.eu. Available at: <https://climate-adapt.eea.europa.eu/en/metadata/case-studies/paris-oasis-schoolyard-programme-france>.

69. Costs based on the Paris Oasis Schoolyard Programme costing around €5,000,000 and retrofitting 760 school yards, this would result in a single cost of around €6,500 per school yard, based on information from: Climate ADAPT (2022). Paris Oasis Schoolyard Programme, France — English. [online] climate-adapt.eea.europa.eu. Available at: <https://climate-adapt.eea.europa.eu/en/metadata/case-studies/paris-oasis-schoolyard-programme-france>.

Deploy a low-emissions heating programme for residential buildings

Support the installation of low-emissions heating technology in residential buildings to transition away from carbon-intensive heating.

RELEVANT THEMES

#buildings #energy #energyefficiency

#resilience #mitigation #NCV #G&EI



Capital Investment (Programme)



BMM Department of Social Services



Bursa-wide



New



Medium (2-5 years)



€ 200,000 Development/advisory costs
€ 70,000,000 Capital costs
€ 0 Operational costs (over 5 years)



Direct Climate Resilience
Direct GHG Emissions - 216,200 tCO₂e/year
Direct G&EI
Direct Smart
Indirect NCV



ACTION 21 Increase capacity within the Energy Efficiency Centre



Buildings – There is no use of coal for household heating.



5 – Gender Equality

7 – Affordable and Clean Energy

11 – Sustainable Cities and Communities

12 – Responsible Consumption and Production

13 – Climate Action

In Bursa, 71% of energy consumption used for heating is attributed to residential buildings, the majority of this heat energy is derived from natural gas⁷⁰. However, based on anecdotal evidence, 4-6% of households across the province still rely on coal for heating purposes. Alternative measures to meet heating energy needs in areas where the Governor's Office and District Governor's Office Social Assistance and Solidarity Foundations provide coal aid. As a result, this has a negative impact on air quality and GHG emissions, where household electricity and fuel use represented 22% of GHG emissions in Bursa as of 2020⁷¹. Moreover, It is important to emphasize that coal-related air pollution and energy poverty disproportionately impact the health of vulnerable groups.

COMPONENTS

1 CREATE A PROGRAMME TO IMPLEMENT LOW-EMISSIONS HEATING TECHNOLOGY TO SUPPORT LOW-INCOME HOUSEHOLDS

The focus of this action is the creation of a programme to implement low-emissions heating technology to support low-income households in transitioning away from carbon-intensive heating. The programme should first focus on the 4-6% of households, these being low-income, still reliant on coal for heating, assumed to be around 45,400 to 68,000 households in Bursa^{72,73}. Several alternative heating and boiler technologies could be proposed.

The programme should provide technical assistance to households and residential building owners in identifying the most suitable low-emissions heating technology for them. This should take any building constraints and financial burden into account.

In developing the programme for Bursa, different financing mechanisms and delivery models should be explored to ensure low-income households are provided with the same opportunities as more affluent households to replace or implement low-emissions heating technology. Finance mechanisms could include for example:

- **Grants** – would involve providing grants to households to implement low-emissions heating technology. Such grants are advised to be means tested and provided on a sliding scale favouring low-income households, this could mean a single-headed female household with little to no income could potentially qualify for a 100% equivalent grant to implement alternative technology;



Source: HomeEnergyScotland, 2025

Heat Pumps

Ideal medium-sized homes with space for outdoor units, providing efficient heating in moderate climates. Various technologies are available, including, air, ground or water source heat pumps. Reliable and renewable electricity supply should be sought to ensure these provide low-carbon heat energy.



Source: Climastar, 2025.

Electric boilers and radiators

Best suited for smaller homes or apartments with limited space and access to a reliable and clean electricity supply.



Source: CentralHeatingNewZealand, 2025.

Biomass pellet boilers

Most suitable for large and/or rural homes with storage space for pellets and access to a consistent supply of biomass fuel. These biomass pellets should be compliant with sustainability regulation to ensure they are considered low carbon. Installations can vary in size from 10 to 100+ kW.



Source: GREEMATCH, 2025.

Solar thermal panels

Most suitable for homes with ample roof space and good sun exposure (i.e., south-facing roofs). These should supplement other heating solutions given the variation in weather in Bursa.

- **Low interest-rate loans** – would involve providing households with the opportunity to take out low-interest rate loans to pay for new equipment and installation costs;
- **On-bill financing** – would involve charging customers a monthly fee against their energy bills to pay back the new equipment and installation costs; and
- **Tax incentives and rebates** – would involve providing homeowners with a tax break or incentive to incentivise uptake and installation of alternative technology.

Local policy and regulation should be reviewed to potentially implement a restrictive policy on coal use for heating, such as issuing fines, to eliminate its use entirely. This will need to take into account the needs of low-income households and ensure it does not punish vulnerable groups who often may not have another option but to use fossil fuels for heating.

TIMELINES

0–6 MONTHS

Carry out a feasibility study, including undertaking a review of socio-economic dynamics to identify key locations across Bursa with high concentrations of potential beneficiaries of the programme, a review of potential technologies and their application in Bursa for specific households, and potential key suppliers and contractors in the region.

6–12 MONTHS

Establish and develop programme details, including reviewing and picking the most appropriate funding mechanisms establishing any necessary governance and implementation procedures, and outlining an application process.

12–15 MONTHS

Undertake awareness raising to inform the public about the programme, its qualification criteria and any application procedures.

12–15 MONTHS

Establish relationships with key suppliers and contractors and provide any technical training or capacity building to assist with the implementation of the chosen technologies.

15–24 MONTHS

Run a pilot of the programme with a small number of participating households ensuring to gather feedback and any lessons learned to improve the implementation of the programme on a larger scale.

24+ MONTHS

Begin a phased rollout of the Residential Building Low-emission Heating Programme implementing any lessons learned and feedback from the pilot.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Need to have a **clear understanding of low-income households**, including their location and building of residence, fuel use for heating, number of dependants etc., to help deliver a targeted programme.
- Potential for the **need to develop qualification criteria for accessing loan funding or grants** by individual households, this could include income, dependencies, age of building or heating installation, etc.
- **Availability of skilled workers and their capacity** for the delivery and implementation of proposed low-emission heating technology in residential buildings.
- **Existence of national and regional supply chains** for the provision of biomass pellets in substantial quantities.



KEY STAKEHOLDERS

- **BMM Department of Social Services**
 - Implementation agency – main components and all steps.
- **BMM Department of Zoning and Urbanisation** –
 - Involve and collaborate – all components and steps.
- **Ministry of Environment, Urbanization, and Climate Change** – Consult – main components and all steps.
- **Natural gas local distribution companies** –
 - Collaborate – All components and steps
- **Private building owners and low-income families** – Consult and involve – main components, steps 1, 3, 5 and 6.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Loans** – Ilbank, IFIs, and commercial banks.
- **Grants** – National government, IFIs (for project preparation) and development organisations.
- **Climate Finance** – For example, the Climate Finance Accelerator or Climate Investment Fund.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes
Potential for revenue generation opportunities depending on the finance and delivery models implemented. Moreover, there are potential cost savings associated with lower energy use as a result of more efficient low-carbon heating systems.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Grants and reduction in bills associated with energy use for heating will most notably support low-income households, often formed of single female-headed households or people with disabilities, to adopt low-emission heating technology. Opportunities to offer skills development, capacity building and job opportunities for women and disadvantaged individuals should be explored, for example, during the procurement of services to deliver the low-emissions heating systems. Such investment will result in improvements in air quality and have a positive impact on the health of women, children, and the elderly, who are most affected by air pollution.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action inherently focuses on building energy resilience. Implementation of heat pumps that offer the ability to both heat and cool buildings provides a means of mitigating extreme heat and improving thermal comfort for people.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – The action contributes directly to emission reduction by facilitating a shift from coal use for heating to low-emission heat sources. GHG emissions reductions have been calculated assuming that 6% of households, these being low-income, in Bursa completely stop using coal for heat energy and switch to alternative low-carbon heating sources.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Several opportunities to enhance smart maturity of the Buildings sector are presented with this action. For example, alternative low-emissions heating technology, such as heat pumps, can be fitted with IoT devices to monitor and collect data which can be used to improve energy efficiency.



IMPACT ON NATURAL CAPITAL VALUE

Indirect impacts – Renewable energy generation using solar PV may contribute to increasing the value from renewable energy ecosystem services.

70. BMM, Bursa Sustainable Energy and Climate Change Adaptation Plan Monitoring and Evaluation Report (BUSECAP), (2022).

71. BMM, Bursa Sustainable Energy and Climate Change Adaptation Plan Monitoring and Evaluation Report (BUSECAP), (2022).

72. Anecdotal evidence gathered during GCAP Bursa Baseline Report.

73. 4-6% of households based on the following assumptions, Bursa population in 2023 of 3.214 million, average household size in the east Marmara Region in 2021 of 2.83, resulting in around 1.135 million households.

Industries

10

Develop a 'Net Zero Carbon Industries Action Plan'

11

Set up a 'Sustainable Industries Help Desk'

12

Develop an industrial waste recycling facility





Develop a 'Net Zero Carbon Industries Action Plan'

Explore and develop feasible decarbonisation pathways in industrial facilities across Bursa.

RELEVANT THEMES

#industries #energy #energyefficiency

#climate&environment



Strategy / Plan / Study



Bursa Chamber of Commerce and Industry (BTSO)



Bursa-wide



Ongoing



Short (<2 years)



€ 1,000,000 Development/advisory costs
€ 0 Capital costs
€ 0 Operational costs (over 5 years)

Indirect Climate Resilience

Indirect GHG Emissions

Indirect G&EI

Indirect Smart

None NCV



None



Industries – GHG emissions from energy and fuel use in industries are 40% lower than 2014.

Industries – At least 6 OIZs are certified as Green OIZs.



9 – Industry Innovation and Infrastructure

13 – Climate Action

Industries in Bursa dominate the economic and geographic landscape. 33% of Bursa's GDP is accounted for by industries and the sector employs 9.23% of Türkiye's industrial workforce. The province has the highest number of OIZs in the country, this being 17 with an 18th in its planning and development phase. As a result, the sector has a large impact on the local environment, particularly GHG emissions. In total industries in Bursa in 2020 accounted for 41% of all GHG emissions (36% from electricity and fuel use in industrial buildings and 5% from industrial processes). These have grown by around 2 million tons of CO₂e between 2014 and 2020, however, there has not been a more recent inventory of GHG emissions to understand this growing trend further.

This action seeks to develop a plan to identify decarbonisation pathways for industrial buildings, manufacturing and processes in Bursa to reduce their GHG emissions. The action also builds on the work undertaken to develop the 2017 Bursa Green OIZ Action Plan and the National Code for Green OIZs by assessing which measures could be scaled up and implemented across all OIZs in Bursa. The BTSO Green and Digital Transformation Centre should be included in the development of the plan to provide advice on best practices for industrial decarbonisation, climate adaptation and resource efficiency.

COMPONENTS

1 DEVELOPING A COMPREHENSIVE BASELINE AND REDUCTION SCENARIOS

- **Detailed GHG emissions inventory for industries** to gain a comprehensive understanding of the impact of industry activities on GHG emissions in Bursa. This will help to identify decarbonisation pathways as part of Component 2.
- **Investigation of resource efficiency opportunities for industry.** Research into potential efficiency options for resource used in industry, such as fuels, raw materials, waste, process water requirements, etc. This will help to identify pathways for efficiencies which could include energy and resource efficiency measures such as heat recovery, streamlining processes e.g. through reducing bottlenecks in supply, switching to lower carbon fuels, modernising equipment and logistics and supply chain optimisation.
- **Assessment of current industries, their processes and future industry needs,** to understand how the industries

sector is currently performing, what are the key sectors and where are they located, occupancy rates of OIZs and potential for land use optimisation, performance of supply chains and how all of this may change in the future given industrial growth and innovation. Land use of industries needs to be balanced against agricultural and other needs.

- **Establish and agree upon decarbonisation pathway and GHG emissions reduction scenarios** using information gathered as part of the assessment to establish a consensus of how much industries should reduce their GHG emissions over the coming years.

2 DEVELOPING THE NET ZERO CARBON INDUSTRIES ACTION PLAN

Using the information and data gathered as part of component 1 and agreed decarbonisation pathway, a Net Zero Carbon Industries Action Plan should be developed to help guide industries in:

- **Increase energy efficiency** by identifying interventions to reduce resource demand, implementing more efficient processing and manufacturing practices, identifying opportunities to optimise the lifecycle of products, etc.
- **Switching to low GHG emission fuels**, for example biogas which is considered carbon neutral, as part of industrial processes to reduce GHG emissions.
- **Investigation for green supply chains opportunities** by facilitating better choosing of suppliers with high environmental standards and sustainability practices, reducing the number of trips and journeys needed to supply goods. The investigation can also consider opportunities for upskilling women and underserved groups, and incorporating inclusive employment and procurement practices.
- **Adopting lean manufacturing principles** to minimise waste and improve resource efficiency, adopting new and advanced equipment, integrating renewable energy generation, etc.
- **Innovation and research** into new and sustainable resources, technologies and manufacturing practices and how these can be leveraged to reduce GHG emissions and minimise environmental impact while benefiting future industries in Bursa.

TIMELINES

0-3 MONTHS

Stakeholder engagement and coordination, to map the stakeholders who should be involved in the development of the Net Zero Carbon Industries Action Plan, including BMM departments, individual industries and businesses, OIZ management agencies, NGOs and CSOs, etc., and creating an engagement plan to ensure these stakeholders are involved and consulted through the development process.

3-12 MONTHS

Component 1 development of comprehensive baseline, including, undertaking any necessary and planned stakeholder engagement, data collection and analysis, and report writing.

12-24 MONTHS

Component 2 development of Net Zero Carbon Industries Action Plan, including, undertaking any necessary and planned stakeholder engagement and developing the Net Zero Carbon Industries Action Plan.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Need to coordinate a wide range of stakeholders**, most notably private large, medium and small businesses, and gather their buy-in for implementing actions to transition to net-zero in the industries sector.
- **Need to identify drivers and benefits** from decarbonisation measures to build buy-in
- **Need for follow-up investment into actions** resulting from the Net Zero Carbon Industries Action Plan.



KEY STAKEHOLDERS

- **Bursa Chamber of Commerce and Industry (BTSO) Green and Digital Transformation Centre** – implementation agency – all components and steps.
- **BEBKA** – Involve and collaborate – Component 1 and step 1 and 3.
- **OIZ management agencies** – Consult – all components and steps.
- **Individual industries** – Consult – all components and steps.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BTO budget assigned awareness of Climate Mitigation and planning.
- **Grant** – National government or IFI and international organisations.
- **Private investment** – as part of industries demonstrating corporate climate and social responsibility.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

No direct revenue generation or cost saving opportunities as a result of this action. However, the Action Plan can identify actions that could potentially result in revenue generation and cost savings.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Measures for gender mainstreaming and inclusive economic growth should be incorporated within the Net Zero Carbon Industries Action Plan.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – When developing the Net Zero Carbon Industries Action Plan, climate and disaster resilience should be taken into account to develop actions which help industries adapt and mitigate climate change.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – While emissions reductions cannot be quantified until the interventions in the Plan are known, the action inherently focuses on reducing GHG emissions from industries. The key mechanisms for GHG emissions reductions in industry include energy efficiency measures including heat recycling, optimisation of processes and replacement of old equipment with newer more efficient alternatives; direct fuel switching to lower carbon forms energy such as biofuels; electrification of equipment from

conventional fuel alternatives – and use of renewable energy; optimising logistics and green supply chain management, optimise loads and streamline supplies.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Indirect benefits - When developing the Net Zero Carbon Industries Action Plan, smart considerations and technologies, for example, IoT and smart sensors for tracking resource consumption, should be included to promote smart initiatives in helping to reduce GHG emissions as part of industrial processes.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.



BSO Service Building, Nilüfer

ACTION 11

Set up a 'Sustainable Industries Help Desk'

Launch a helpdesk to provide technical assistance on modernization, decarbonisation and increasing resource efficiency of industrial facilities.

RELEVANT THEMES

#industries #energy #energyefficiency

#circulareconomy



Capacity-building / Awareness Programme



Provincial Directorate of Industry and Technology
Green and Digital Transformation Centre



Bursa-wide



Ongoing



Short (<2 years)



€ 50,000 Development/advisory costs

€ 0 Capital costs

€ 750,000 Operational costs (over 5 years)

Indirect Climate Resilience

Indirect GHG Emissions

Indirect G&EI

Indirect Smart

Indirect NCV



None



Industries – GHG emissions from energy and fuel use in industries are 40% lower than 2014.

Industries – At least 6 OIZs are certified as Green OIZs.

Industries – The proportion of industrial waste that is reused or recycled is greater than 80%.



9 – Industry Innovation and Infrastructure

13 – Climate Action

Understanding how to reduce industrial impact on local environments can often be a challenge given the complexity of environmental regulations, and lack of resources and capacity. Coupled with the diverse nature of industrial activities in Bursa, this can make it challenging to identify effective actions and strategies for minimising environmental impacts

COMPONENTS

1 SET UP A 'INDUSTRIES HELP DESK' AS A 'ONE-STOP-SHOP' FOR CREATING AWARENESS

The main component of this actions is to set up a 'Industries Help Desk' to act as a 'one-stop-shop' for creating awareness, building capacity and offering technical assistance and advice to help industries modernise and decarbonise their operations as well as increase resource efficiency. The overall aim is to build capacity to assist industries in minimising their environmental impact across the Province.

The Help Desk should provide advice and capacity building on the following topics:

- **Environmental pollution monitoring and reduction** by monitoring of discharge and emission indicators related to air quality and wastewater.
- **Circular economy and resource efficiency** by advising on good practices in waste recovery. Evaluation of recovered materials by organizations within a symbiotic network.
- **Complying with and obtaining international accreditations**, for example, those developed by the International Organization for Standardization (ISO) for energy management (ISO50001), environmental management (ISO14001) or adaptation to climate change (ISO14090).
- **Accessing funding for green and sustainable initiatives** in the industries sector, for example, through existing programmes implemented by international finance institutions, including the EBRD's Türkiye Industrial Decarbonisation Investment Platform⁷⁴ or the World Bank Türkiye Green Industry Project⁷⁵.
- **Reviews of process optimization and development of specific plans for improvement** by conducting detailed tracking of resources and work to minimize resource consumption in relation to

production, in particular relating to water consumption given its scarcity in the region.

- **Creating a platform for sharing information on best practices** by developing a platform or forum of information exchange and encouraging greater disclosure of industrial impacts on people and the environment and actions to mitigate these. This could also be a good way to encourage social reform in the sector, for example, enhancing gender equality.
- **Hold expert-led engagement sessions** to discuss GHG emission sources and opportunities for decarbonisation across each industry group, building capacity/ understanding across local industries and supply chain.

TIMELINES

0–6 MONTHS

Initial planning and research, to define the objectives and intended outcomes of the Help Desk, this could also include undertaking a rapid needs assessment of Bursa industries to understand what information and technical assistance is needed, and research into best practices and actions already undertaken by industries in Bursa and how further support could be provided to expand these further.

9–12 MONTHS

Develop the services and technical assistance which will be delivered by the Help Desk based on the initial planning and research.

12–15 MONTHS

Set up any necessary infrastructure, equipment and staffing, this could include leasing an office, buying new office equipment, hiring new staff, training and upskilling existing staff (including where possible focusing on women and disadvantaged individuals to ensure equal participation in opportunities for upskilling employees), etc.

15–24+ MONTHS

Begin offering the services and technical assistance to industries across the Province.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Need to understand OIZ and individual industry needs and requirements to tailor the type of technical advice offered.
- Capacity and skills of existing staff of the implementation agencies to provide the necessary technical assistance, awareness and capacity building as proposed by the action. This may require hiring new staff and specialists and/or providing training to upskill existing staff.
- Appetite and uptake from industries in Bursa for obtaining technical assistance services.



KEY STAKEHOLDERS

- **Provincial Directorate of Industry and Technology** – Implementation agency – main components and steps.
- **Green and Digital Transformation Centre** – Implementation agency – main components and steps.
- **Bursa Chamber of Commerce and Industry** – Collaborate and involve – main component and steps 2 and 4.
- **Bursa Chamber of Commerce and Industry Education Foundation** – Collaborate and involve – main component and steps 2 and 4.
- **Universities** – Collaborate – main component and steps 2 and 4.
- **OIZ management agencies** – Consult – main components and steps 1 and 4.
- **Individual industries** – Consult – main components and steps 1 and 4.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – Provincial Directorate or Green and Digital Transformation Centre budget assigned for awareness raising and capacity building.
- **Grant** – National government or IFI and international organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

No direct revenue generation or cost saving opportunities as a result of this action.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The action involves job creation for around 5 new staff offering technical assistance and support to industries. These should promote equal access to employment, including for women and disadvantaged individuals. Assistance provided should consider G&EI elements, for example, sharing best practices for implementing gender equality in industries. Any training on delivering technical assistance should focus on women and disadvantaged individuals to ensure equal participation in opportunities for upskilling employees.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Technical assistance and support provided through the Help Desk should consider the impacts of climate change and help industries build climate-resilient operations.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – The focus of the technical assistance through the Help Desk is to drive implementation of net zero solutions like electrification of industrial equipment, powered by renewable energy by promoting the use of alternative lower carbon fuels, identify energy and resource efficiency, optimized transportation and undertaking supply chain management.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Technical assistance can include the modernisation of processes and manufacturing practices employing the latest technology where possible.



IMPACT ON NATURAL CAPITAL VALUE

Indirect impacts – Technical assistance on environmental pollution monitoring and reduction can support the awareness of impacts on ecosystems and the services they provide. Moreover, technical

assistance to reduce pollution could inform or facilitate additional actions that could decrease pressures on nature and/or enhance ecosystem services further. Collecting evidence of ecosystem service provision (e.g. air quality, water quality) can enable access to green and sustainable financing initiatives to demonstrate added value of nature.

74. EBRD, Türkiye launches industrial decarbonisation investment platform, (2024), Available at: <https://www.ebrd.com/home/news-and-events/news/2024/trkiye-launches-industrial-decarbonisation-investment-platform.html>, Accessed 01/04/2025.

75. World Bank, Türkiye Green Industry Project, (2025), Available at: <https://projects.worldbank.org/en/projects-operations/project-detail/P179255>, Accessed: 01/04/2025. 2023 of 3.214 million, average household size in the east Marmara Region in 2021 of 2.83, resulting in around 1.135 million households.



TOGG Automobile Factory

ACTION 12

Develop an industrial waste recycling facility

Study different types of industrial waste produced in Bursa and explore viable pathways for their recycling, reuse, and resale.

RELEVANT THEMES

#industries

#solidwaste

#G&EI

#circulareconomy



Capital Investment (Project)



BISO (Green and Digital Transformation Centre)



To be determined, the industrial recycling facility could be co-located with other solid waste management facilities in the east or west of Bursa or close to an area of high industrial activity.



Planned



Medium (2-5 years)



€ 500,000 Development/advisory costs
€ 10,000,000 Capital costs
€ 1,600,000 Operational costs (over 5 years)



Indirect Climate Resilience
Indirect GHG Emissions
Direct G&EI
Indirect Smart
Indirect NCV



ACTION 25 Improve performance through digital and governance initiatives



ACTION 28 Implement the Western Regional Integrated Solid Waste Disposal Facility



Solid Waste – Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.

Industries – GHG emissions from energy and fuel use in industries are 40% lower than 2014.

Industries – The proportion of industrial waste that is reused or recycled is greater than 50%.

9 – Industry Innovation and Infrastructure

12 – Responsible Consumption and Production

13 – Climate Action

Based on the sector and waste type, it is recommended to identify waste that is not deemed suitable for use in other purposes and to identify options for value-added use cases and waste recovery. Additionally, the aim is to examine the possibility of evaluating waste that is currently recovered and used in a more value-added manner.

Therefore, this action will include undertaking a study to better understand industrial hazardous and non-hazardous waste streams in Bursa as well as developing an industrial waste recycling facility (including appropriate treatment and disposal) to handle different industrial waste streams and prepare these for eventual reuse and resale.

COMPONENTS

1 INDUSTRIAL HAZARDOUS AND NON-HAZARDOUS WASTE STREAM STUDY

- Identify industrial hazardous and non-hazardous waste types, their sources and volumes to develop a baseline understanding relating to various industrial waste streams;
- Identify current treatment and disposal methods, as well as potential opportunities in the future. This should focus on identifying appropriate treatment and disposal technologies, and an assessment of the costs and benefits of undertaking treatment and disposal in Bursa as opposed to transporting hazardous waste outside the Province;
- Assess the current governance and institutional set up currently in place for industrial hazardous and non-hazardous collection and transport, contracts between generators and collectors and their duration, and potential changes needed to improve operations; and
- Identify any potential supply chains for recovered industrial waste and possibilities for revenue generation.

2 INDUSTRIAL WASTE RECYCLING FACILITY

Given the limited information about industrial waste, a feasibility study for the Industrial Waste Recycling Facility built upon the outcomes of Component 1 should be undertaken. This would include site selection, due diligence, environmental impact assessments and preliminary choice of technology and design of the facility. The resources and cost associated with the facility could therefore differ

significantly depending on the outcomes of the studies and technology chosen. This could be co-located with the new Integrated Western Solid Waste Management Facility (Action 28).

It is, however, understood that there are large volume of textile processing and dye houses in Bursa. Therefore, the initial focus of the facility should be on textile waste (as highlighted in the BEBKA Regional Plan 2024-2028). The facility should include infrastructure to handle and transfer, sort (based on quality and type of textile), and undertake any necessary treatment. The facility should prepare the textiles for resale and reuse in other textile manufacturing processes. Opportunities to increase the volume of textile waste being handled at the facility should also be explored, including, handling industrial textile waste. Collection is under the authority of the District Municipalities, while disposal is under BMMs authority. Based on the outcomes of Component 1, the facility can be expanded to handle different industrial recyclable waste streams in the future.

An element of this component should explore suitable waste collection approaches enabling operational sustainability, for example, setting up shared solid waste management contracts for the collection and transport of specific waste streams. This could explore funding new collection vehicles.

The facility should also include any necessary infrastructure low-carbon production. Any storage and staff buildings should also be fitted with energy and water efficiency measures and devices, such as LED lighting and rainwater harvesting, to ensure efficient resource use. Such measures will help to reduce the facility's GHG emissions and environmental impacts.

TIMELINES

0–9 MONTHS

Undertake Component 1 and develop a comprehensive baseline understanding of industrial hazardous and non-hazardous waste streams in Bursa, this should include undertaking any necessary and planned stakeholder engagement.

6–9 MONTHS

Develop a stakeholder engagement plan to identify key stakeholders and engagement activities with the aim of keeping stakeholders and the general public informed through the development of the action.

9–24 MONTHS

Undertaking Component 2, including, any necessary due diligence and feasibility studies, identifying the most appropriate production model for the industrial waste recycling facility and developing a detailed design, this should also include obtaining any necessary planning and construction licences.

24–48 MONTHS

Begin implementation activities associated with the Industrial Waste Recycling Facility, this includes procurement of construction and waste management services (if necessary) and necessary auxiliary infrastructure and services.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Stakeholder engagement** will be a key element of the development of this action given the sensitivity of dealing with industrial hazardous and non-hazardous waste and past challenges that have arisen in the solid waste sector when trying to implement new waste management facilities.
- **Site selection** will also be key to ensure appropriate locations for the industrial recycling facility, this could be co-located with existing waste management facilities or in close proximity to industrial activities.



KEY STAKEHOLDERS

- **BTSO (Green and Digital Transformation Centre) – Implementation agency – all components and steps.**
- **BMM Department of Environmental Protection and Control – Collaborate and Involve – all components and steps.**
- **District Municipalities - Involve – component 2 and steps 2, 3 and 4.**
- **BEBKA – Consult – component 2 and steps 3, 4 and 5.**
- **Universities – Collaborate and Involve – in particular component 1 and step 1.**



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to planning solid waste management.
- **Grant** – National government or IFI and international organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Some raw materials required by certain industries can ultimately be produced at more affordable prices compared to primary raw material options through the activities of the proposed industrial waste recovery facility.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The enhanced understanding of industrial hazardous and non-hazardous waste in the province and appropriate treatment and disposal techniques will help improve the local environmental quality and reduce the impact of industrial waste on the local population. The action has the potential to generate 10 jobs during the operation of the industrial waste recycling facility. Opportunities to provide jobs for underserved and vulnerable groups, including women and people with disabilities, should be maximised. Skills gaps relating to new technologies should be identified and training provided to upskill employees, where appropriate focusing on women and disadvantaged individuals.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The development of the waste recycling facility should look to implement measures to mitigate climate-related risks such as urban flooding. Moreover, disaster resilience considerations, such as ground stability and geology, should be considered when selecting the site for the new facility to avoid areas prone to landslides or ground instability during earthquakes.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – The waste recycling facility offers opportunities for GHG emissions reduction by promoting circularity and recycling of materials as compared to standard approach to disposal of industrial waste.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The action presents opportunities to incorporate IoT devices to improve the management of the facility and collect data associated with industrial solid waste. This data can feed into the Digital Solid Waste Management Platform as part of Action 25 and help to build a clearer picture of industrial waste streams in Bursa.



IMPACT ON NATURAL CAPITAL VALUE

Indirect impacts – The selection of the site for the new facility should avoid areas of high natural capital value (e.g. woodlands, wetlands) or protected/irreplaceable habitats.



Bursa Organized Industrial Zone, Nilüfer

Transport

13

Expand the metro /
light rail network

14

Develop micro-mobility
infrastructure across Bursa

15

Transition to a low-emission
bus fleet with supporting
infrastructure

16

Enhance operations of the
transportation system
through smart interventions





İpekböceği Tram Line

Expand the metro / light rail network

Implement the planned metro line and supporting infrastructure to maximise its usage.

RELEVANT THEMES

#transport

#landuse

#TOD

#G&EI

#mitigation

#NCV



Capital Investment (Project)



BMM Department of Railway Systems



Across the metropolitan region (all or mostly Urban Districts)



Ongoing and new



Long (> 5 years)



€ 5,000,000 Development/advisory costs



€ 975,000,000 Capital costs



€ 242,900,000 Operational costs (over 5 years)

Direct

Climate Resilience

Direct

GHG Emissions - 190,770 tCO₂e/year

Direct

G&EI

Direct

Smart

Direct

NCV - €2,978,117 annual NCV impact

ACTION 3

Undertake urban redevelopment along planned metro lines



ACTION 14

Develop micro-mobility infrastructure across Bursa

ACTION 15

Transition to a low-emission bus fleet with supporting infrastructure

**Transport** – Total length of rail system network is 131.5 km.**Transport** – Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.

5 – Gender Equality

7 – Affordable and Clean Energy

11 – Sustainable Cities and Communities

13 – Climate Action

Bursa metropolitan area is served by several tram and LRT lines (referred to as metro lines in the Bursa context) including:

- **Two LRT lines with a total length of 39 km with 38 stations**⁷⁶; **M1** (between Geçit and Arabyatağı stations) and **M2** (between University and Kestel station); and
- **Three tramlines with a total length of 16 km with 35 stations**⁷⁷; **T1** (between Kent Meydani and Heykel stations), **T2** (between Kent Meydani and Terminal stations) and **T3** (between Zafer Plaza and Çınarönü stations).

However, there are several rural areas of the city which are underserved by mass transit. Moreover, between 2011 and 2018 the share of public transport as a mode decreased from 43.27% to 39.72% while car trips increased from 29.61% to 34.50%⁷⁸. Besides, the ownership of private vehicles has been increased by around 8.3% a year during the same period. This trend is expected to have continued over more recent years. As a result, in 2020 transport was the third largest contributor to Bursa's GHG emissions accounted for 20% of emissions in the city. With the aim of resolving some of the issues discussed above, The Transportation Master Plan (TMP) 2035 planned for the implementation of two new Metro lines in the metropolitan area (shown in Figure B5), these include:

- **New Metro Line 3 (M3)** - between Beşevler KSS and Otosansit, between Çalı and Beşevler KSS and between Otosansit and Gürsu, with a total length of 29 km; and
- **New Metro Line 4 (M4)** - between Beşevler KSS and Yunuseli, between Yunuseli-Demirtaş and between Çalı and Beşevler KSS, with a total length of 21 km.
- **Extensions to existing LRT lines** – for example the extension of M1 to the City Hospital.

However, since the inception of the TMP 2035, M3 has been deemed unfeasible and therefore will not deliver within this period.

In line with plans proposed by the TMP 2035, this component of this action seeks to expand the metro/ LRT network to connect underserved areas of the city with mass transit as well as modernize the metro vehicle fleet and develop integrated transfer hubs as well as park-and-ride facilities. The aim of this is to encourage the use of public transit as a primary mode of transportation across the metropolitan area reducing the use of private vehicles and road congestion and reducing the GHG missions associated with the transport sector across the city.

COMPONENTS

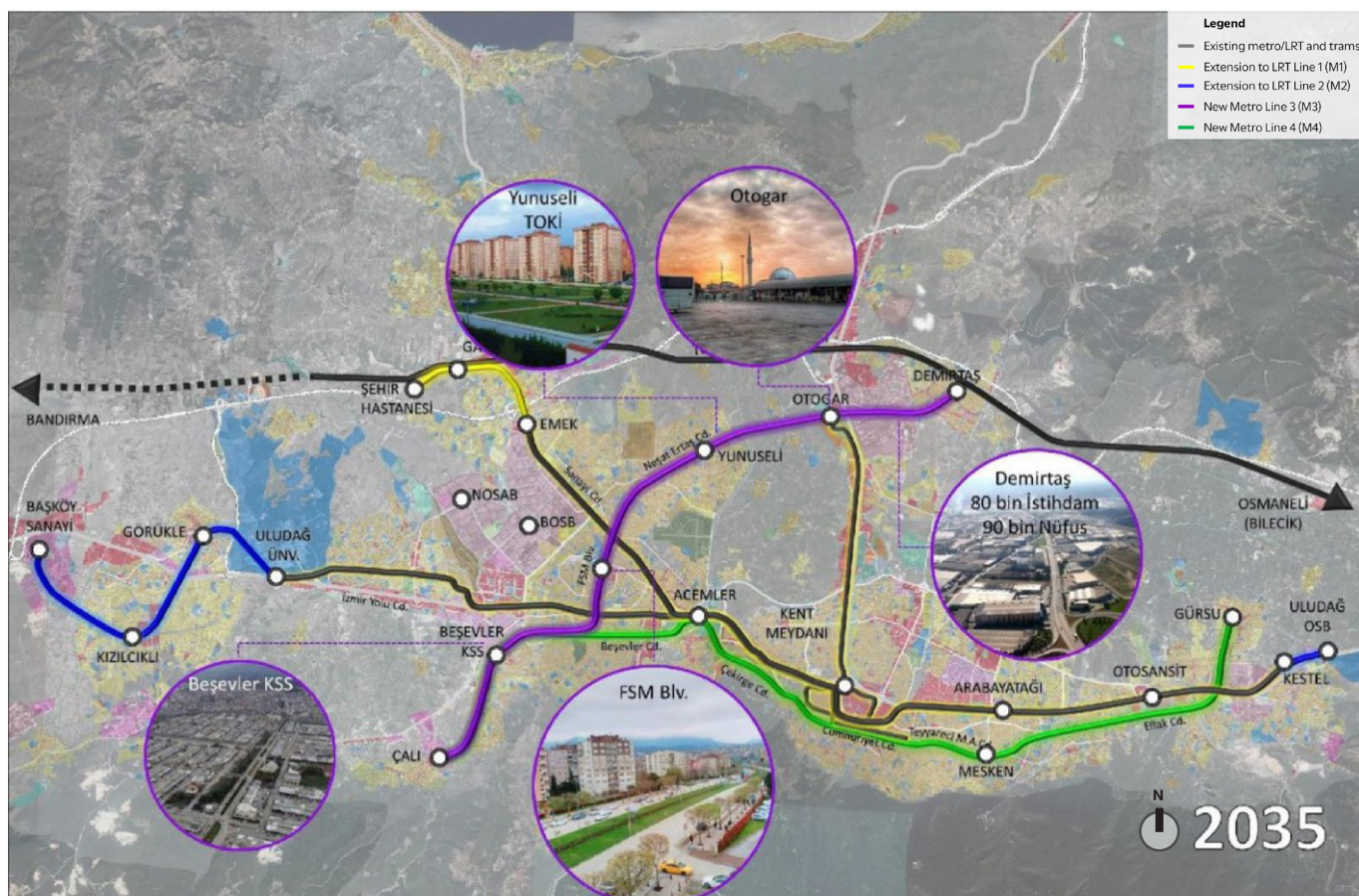


Figure B5: Map of Bursa's future metro/LRT network by 2035

Source: BMM⁷⁹

1 IMPLEMENTATION OF THE METRO LINE 4 PROPOSED AS PART OF THE TMP 2035

Construct the 21km new M4 metro line, including the accompanying stations and public realm improvements, any necessary depots for vehicle storage and maintenance, and auxiliary infrastructure, such as incorporating solar PV at depots to generate renewable energy.

All new stations along the line should be designed with accessibility and safety for all in mind, include CCTV and measures to reduce gender-based violence and smart technology such as digital information screens, and incorporate NbS and SuDS where possible to build climate resilience.

The TMP 2035 also planned for the extension of the M1 and M2 lines with elements of this currently being realised. The feasibility of these extensions, as well as the need for any further metro lines to support the sustainable transport of people across the city, should be considered in further detail after the implementation of the new metro line.

2 FLEET EXPANSION AND MODERNISATION

This component will be based on the procurement of new vehicles for the ongoing extension works for the LRT line 1 (M1), between the "Emek-City Hospital" and "University-Görükle" stations, as a detailed feasibility for these has been completed, and includes the **procurement of 48 new vehicles**⁸⁰. The need for new vehicles to accommodate additional passengers on the new M4 line and extensions to the existing lines will need to be assessed as part of a detailed feasibility; therefore these costs have not been factored into the action.

The new vehicles should be designed with accessibility for various vulnerable groups in mind, offering various options for seating and standing, and having good lighting to promote safety at night. The new vehicles should also have screens displaying the route, upcoming stops and possible transfers, and carriage capacity to provide passengers with key information.

3 TRANSFER HUBS AND PARK-AND-RIDE FACILITIES

To accompany the expansion of the metro/LRT network, this component looks to:

- Enhance key transfer hubs as transfer points between various modes of transportation. As laid out in the TMP 2035, this component seeks to improve transfer hubs, these being: Mimar Sinan, Yüksek İhtisas, İhsaniye, Şehir Hastanesi, Kızılçıklı, Korupark, and Kestel transfer hubs⁸¹. These should include micro-mobility parking stations and bike-sharing docking stations (linked to Action 14) as well as NbS and SuDS to help build climate resilience and manage surface water.
- Develop park-and-ride facilities to enable residents and visitors to transition easily from their private vehicles to the public transit network. These are intended to be initially developed in parking lots around the proposed transfer hubs and should be designed with accessibility and connectivity in mind. These should be designed to include micro-mobility parking stations for bicycles and scooters (linked to Action 14) and electric car charging stations, and incorporating NbS and SuDS to help build climate resilience and manage surface water.

The aim of enhancing key transfer hubs and developing park-and-ride facilities is to streamline connectivity between urban and rural areas and for visitors transferring onto the public transport network and between modes, reducing congestion in the inner city, improving accessibility, and promoting a shift towards public transit use.

TIMELINES

COMPONENT 1:

0–3 MONTHS

Establish the team/structure within BMM Transport Department to deliver the project.

0–6 MONTHS

Develop a detailed stakeholder engagement plan to identify key stakeholders and engagement activities with the aim of keeping stakeholders and the general public informed through the development of the action.

3–12 MONTHS

Review existing and undertake any additional feasibility and due diligence studies, this should include engagement with stakeholders and communities on the proposed alignment, station locations, etc.

0–12 MONTHS

Development of the top-level transportation scheme with its proposal to see the requirement of funding, financing opportunities and prioritisation exercise. (This can be done parallel to Step 2 and Step 3)

12–30 MONTHS

Preparing the technical documents such as design and technical specifications. The first 12 months are for preliminary design and cost estimates while the next 12 months are for detailed engineering and specifications.

30–36 MONTHS

Procurement of the construction works, involving tendering process and finalizing contracts, approvals, and ensuring compliance with the regulations/specifications.

36+ MONTHS

Implementation of construction works, including construction of the new metro/LRT lines, signalling system, depots, E&M works and stations.

POST COMPLETION OF CONSTRUCTION WORKS

Testing and completing any necessary final steps before opening the new metro/LRT.

COMPONENT 2:

0–9 MONTHS

Review existing Feasibility and due diligence and develop any necessary new studies for the fleet expansion and modernization.

24–30 MONTHS

Procure and pilot the running of the new vehicles to ensure readiness for roll out across the network.

30+ MONTHS

Roll out the new vehicles across the network and new metro/LRT lines once these are complete.

COMPONENT 3:

0–6 MONTHS

Development of stakeholder engagement plan to make a holistic evaluation for the location-based needs for transfer hubs and park-and-ride facilities.

0–12 MONTHS

Feasibility and due diligence together with the stakeholders to determine the locations to be developed as transfer hubs and/or park-and-ride facilities.

12–24 MONTHS

Design and engineering of these points by increasing the public transportation integration. This step will also include an assessment for the infrastructural requirements.

24–30 MONTHS

Procurement of construction and services based on the assessment.

30–48 MONTHS

Construction and implementation of the transfer hubs and park-and-ride facilities.

48+ MONTHS

Monitoring and evaluation of the transfer hubs and park-and-ride facilities regularly and making the necessary adjustments on these sites based on the monitoring results.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Need to secure **funding to continue the expansion of metro/light rail integrated** with enhanced transfer hubs as well as park-and-ride facilities.
- **Lack of capacity to implement, maintain and operate the system may create technical risk.**
- **Failure to realize the protocol** signed between BMM and Infrastructure Investments General Directorate (AYGM) on rail system lines⁸².
- **The need for detailed design** for new metro/LRT lines, stations, transfer hubs and park-and-ride facilities.
- **Stakeholder engagement** will be key as this action will result in a lot of disruption during its construction phase.



KEY STAKEHOLDERS

- **BMM Department of Railway Systems** – Implementation agency – all components and steps.
- **BMM Department of Zoning and Urbanisation** – Collaborate – all components and steps
- **District Municipalities** – Collaborate – all component and steps
- **BURULAS** – Collaborate – all components and steps
- **AYGM** – Collaborate – all components and steps
- **Community groups** – Consult – all components and steps relating to stakeholder engagement and design.
- **Vulnerable population representatives (e.g., NGOs, and civil society groups)** – Consult – all components and steps relating to stakeholder engagement and design.
- **Universities and research institutes** – Consult – all components and steps relating to stakeholder engagement and design.
- **Infrastructure institutes (such as water, electricity, and natural gas)** – Consult – all components and steps.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to transport management, revenues from land value capture mechanisms (sale / lease of housing or commercial units, tax increments etc.).
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.
- **Climate financing** – from various programmes targeting climate mitigation and adaptation initiatives.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Increasing the number of metro lines will result in more people using the network and buying tickets. There is also a possibility of revenue generation from charging for parking fees at the park-and-ride facilities.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Implementation of this action brings significant job creation potential, with up to 1,000 jobs created depending on scale. To promote equality of opportunity, policies should support employment in construction for women and underserved groups through equal opportunity policies and practices, inclusive procurement, skills development programs, and partnerships with women's cooperatives. Infrastructure should be designed for safety and accessibility, incorporating features like ramps, elevators, non-slip surfaces, CCTV and adequate lighting. Planning and monitoring should involve women's organizations, disability associations, and NGOs representing disadvantaged groups.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The new metro/LRT line, any new stations, transfer hubs and park-and-ride facilities should be designed with climate and disaster resilience in mind, ensuring these adhere to national building codes and minimise risk from climate and natural disaster hazards. NbS and SuDS should be incorporated where possible to help build resilience to climate risks, manage surface water runoff, provide shade and cooling and offer other ecosystem benefits.



IMPACT ON GHG EMISSION REDUCTION

Direct benefits – This action can help reduce GHG emissions by promoting a shift from private vehicle use to public transit use. Based on analysis undertaken for the TMP2035, the M4 line is anticipated to transport around 288,000 passengers a day once it is fully operational. The GHG emissions calculations assumes that these passengers switch from private vehicles to the M4 line for undertaking the average journey length across Bursa (around 10.65km), resulting in savings of around 190,770 tCO₂e/year.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – There are several opportunities for incorporating smart and innovative technology in the design of the new metro line/LRT, new stations, vehicles and transfer hubs. These include digital displays for disseminating information to passengers, CCTV and monitoring for safety, and monitoring and sensor equipment to manage vehicle and passenger movement. The new metro line and vehicles should be linked up to a digital asset management platform to collect key data and help with the operation and maintenance of all the new assets.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – Recreation and tourism and cultural ecosystem services will be improved due to improved access and mobility between urban and rural areas. The selection of sites for new stations, transfer hubs, and park-and-ride facilities should avoid areas of high natural capital value (e.g. woodlands, wetlands) or protected/irreplaceable habitats.

Estimated annual NCV impact: €2,978,117

This action is likely to have positive impacts on the recreation ecosystem service. Ecosystem service impact not valued, considering the 'top-down' valuation approach used for this Action.

76. TMP 2035

77. TMP 2035

78. TMP 2035

79. BMM, (2025), Projects. Available at: <https://www.bursa.bel.tr/projeler/cali-demirtas-metro-hatti-133>

80. BMM (2023). Çalı-Demirtaş Railway System Line Feasibility Study Report. Table 19.

81. TMP 2035

82. BMM Strategical Plan 2025-2029



İncirli-Zafer M. Tram Line



Develop micro-mobility infrastructure across Bursa

Implement additional bicycle lanes, bike-sharing infrastructure and public awareness campaigns to enable expansion and safe use of micro-mobility vehicles.

RELEVANT THEMES

#transport

#landuse

#sustainablemobility

#mitigation

#NCV

#TOD

#G&EI



Capital Investment (Project)



BMM Department of Transport



Urban Districts (all or mostly)



Planned



Medium (2-5 years)



€ 225,000 Development/advisory costs
 € 13,200,000 Capital costs
 € 264,000 Operational costs (over 5 years)



Direct Climate Resilience
Direct GHG Emissions - 43,000 tCO₂e/year
Direct G&EI
Direct Smart
Direct NCV - €2,978,117 annual NCV impact



ACTION 13 Expand the metro / light rail network
ACTION 16 Enhance Smart Transportation System

**Transport** – Total length of the bicycle network is 521 km.**Transport** – Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.

5 – Gender Equality
7 – Affordable and Clean Energy
11 – Sustainable Cities and Communities
13 – Climate Action

As stated in the TMP 2035, cycling and walking is one of the most popular modes of transport accounting for 42.4% of all trips taken across the city in 2010. This is an encouraging figure, however more action can be undertaken to elevate it further given private vehicle ownership rose 8.3% a year between 2010 and 2017. Moreover, many stakeholders raised several issues regarding micro-mobility safety and miss use. This can discourage users from undertaking non-motorised journeys across the city.

In terms of infrastructure provision, there are currently 356km of bicycle lanes across the city. 71 km of these bike paths are located in parks and are available for recreational use. The remaining 285 km of bicycle lanes have been constructed along roads and are typically marked with simple paint or road markings. Bicycle lanes created in this way are not suitable for road and cyclist safety. In some cases, bicycle lanes are obstructed by street furniture and infrastructure and can often be blocked by parked vehicles, as shown in Figure B6. A total of 211 bicycle parking areas can be found across 10 Districts, including Gemlik, Gürsu, İnegöl, İznik, Kestel, Mudanya, Mustafakemalpaşa, Nilüfer, Osmangazi and Yenişehir⁸³. However, there is a lack of cycle parking at key transport hubs and public transport stations which limits the possibility for passengers to easily switch between different modes of transport.

Bursa is also home to a smart bicycle sharing system called 'Nilesipit' operated by Nilüfer Municipality. Private micro-mobility companies operate in the city and offer users with the opportunity to hire electric scooters through apps. However, there is a lack of parking areas for other micro-mobility vehicles, such as electric scooters, often resulting in many of these being parked at random locations along roadsides and pavements, as shown in Figure B7.

Therefore, this action aims to expand micro-mobility infrastructure with the goal of making it safer and more convenient to use. This action will result in multiple benefits for the city, most importantly promoting a shift towards further non-motorised transport use which will improve air quality and reduce GHG emissions.

83. BMM, Transportation Master Plan

COMPONENTS

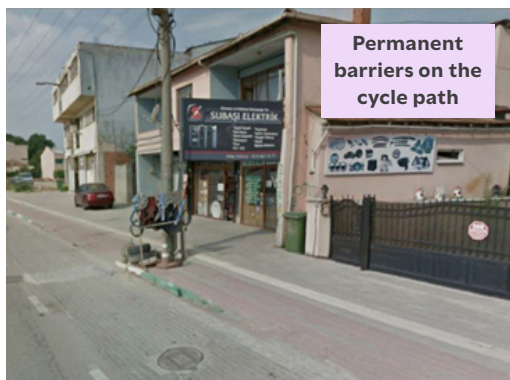


Figure B6: Photos of obstructed bicycle lanes.

Source: TMP 2035



Figure B7: Photos of micro-mobility vehicles parked in unsuitable locations

Source: AtkinsRéalis 2024

1 DEVELOPING A MICRO-MOBILITY MASTERPLAN

The Micro-Mobility Masterplan should be developed to emphasise a holistic approach to development and expansion of micro-mobility services across the Province. As part of the master planning activities, an assessment to develop a baseline understanding of current and future micro-mobility use across the city should be undertaken. The masterplan should be prepared to sit alongside and compliment the TMP 2035. However, it should have its own vision, strategical goals, and targets with a focus on providing a framework for micro-mobility infrastructure, management and operation across the City. The plan should also inform the need for parking reform and traffic policy enforcement to help avoid persistent challenges, such as cars parking in cycle lanes.

2 MICRO-MOBILITY INFRASTRUCTURE DEVELOPMENT

This component includes the development of the following micro-mobility infrastructure:

- Construction of 55km new bicycle lanes, integration these with existing infrastructure to connect neighbourhoods, Districts and key activity hotspots, such as universities, health centres, tourist attractions and open green spaces. Based on the TMP 2035

(see Figure B8) and the Micro-mobility Masterplan, a detailed design of proposed lanes should be developed, this should include dedicated bicycle lanes along roads where there is available space or enhanced pavement markings along shared surfaces. This new bicycle lanes and network will need to be well-designed with safety and accessibility in mind, this might include the need to move street furniture or remove on-street parking to accommodate new bicycle lanes.

- Procurement of 250 micro-mobility vehicles, such as standard and electric bikes and scooters, and any necessary docking stations to begin developing a larger network of shared bikes across Bursa City.
- Implementation of necessary road pavements markings and road signs for safety.
- Improvements to the arrangement of intersections and pedestrian crossing where necessary.
- Construction of micro-mobility parking areas at key destinations – specifically around key activity hotspots and the transfer hubs developed as part of Action 13.

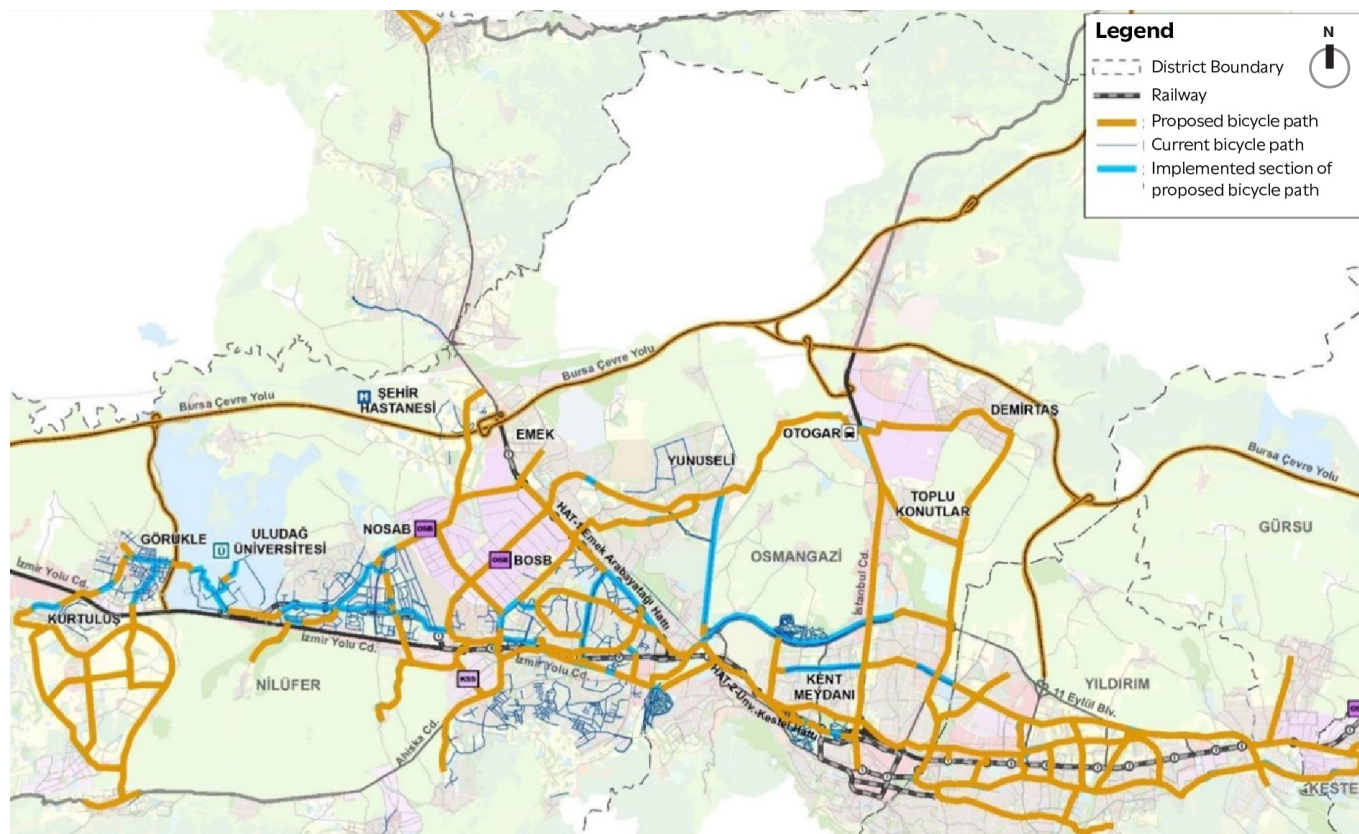


Figure B8: TMP 2035 proposed bicycle network. Source: TMP 2035
Source: AtkinsRéalis 2024

3 MICRO-MOBILITY AWARENESS RAISING CAMPAIGN

Efforts to raise safety and the significance of greater uptake of micro-mobility vehicles in respect to reducing GHG emissions exist at the national and metropolitan levels. However, further action is needed to change individual citizen behaviour and promote a generate a shift in culture. This also has the potential to encourage adoption and consequently reduce reliance on fossil fuel based private vehicles and lower GHG emissions associated with the transport sector in Bursa. Awareness raising activities could include:

- Campaign to promote public awareness of safe micro-mobility use.
- Creating and initiating bicycle tours across natural and ecological areas within the City.
- Specific courses, especially for younger and older population, to encourage them to use bicycles.

TIMELINES

COMPONENT 1:

0–3 MONTHS

Establish a new unit as part of the Bursa Department for Transport specialised in micro-mobility vehicles to oversee all activities relating to micro-mobility.

0–3 MONTHS

Planning and Stakeholder Engagement to understand the key stakeholders involved in the development and delivery of micro-mobility infrastructure as well as to keep them informed throughout the implementation of the action.

3–9 MONTHS

Data Collection and Baseline Assessment to analysing the existing micro-mobility infrastructure and identify future needs.

9–15 MONTHS

Develop the Micro-mobility Masterplan including vision, goals, KPIs, and all other implementation and investment details.

COMPONENT 2:

To be completed after the development and approval of the Micro-Mobility Masterplan.

15–21 MONTHS

Develop a stakeholder engagement plan using the information gathered for the Micro-Mobility Masterplan to identify engagement activities with the aim of keeping stakeholders and the general public informed through the development of the action.

21–27 MONTHS

Feasibility and due diligence for the proposed bicycle lanes and supporting infrastructure, as well as the purchase of new micro-mobility vehicles.

27–33 MONTHS

Design and engineering of proposed bicycle lanes following the TMP 2035 and Micro-mobility Masterplan, including any supporting infrastructure such as docking stations and micro-mobility parking areas.

33–48 MONTHS

Procurement and infrastructural development, purchasing new micro-mobility vehicles and undertake constructing and implementation of new bicycle lanes, docking stations and parking micro-mobility facilities.

COMPONENT 3:

0–9 MONTHS

Development of awareness campaign material, development of public awareness raising on the benefits of micro-mobility vehicle usage.

9+ MONTHS

Launch the awareness raising campaigns, alongside any training and specific courses for Bursa residents.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Stakeholder perception and **uptake of micro-mobility are often linked to the perception of safety** so dedicated bicycle lanes and awareness raising should enhance this.
- **The use of micro-mobility vehicles, such as, bikes may cause an increase in traffic accident rates**, this will need to be monitored, and appropriate awareness-raising activities undertaken.
- Bursa's **existing infrastructure may be insufficient to create an integrated cycling routes** and network with its Districts, this may be due to narrow streets etc., therefore the network will need to be well designed.



KEY STAKEHOLDERS

- **BMM Department of Transport** – Implementation agency – all components and steps.
- **District Municipalities** – Collaborate – all component and steps.
- **UKOME** – Collaborate – all components and steps.
- **Universities and research institutions** – Consult – all components and steps.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to solid waste management.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.
- **Private Investment** – through commercial micromobility services operators
- **Climate financing** – from various programmes targeting climate mitigation and adaptation initiatives.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Potential to charge users for using micro-mobility vehicles.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Expanding bicycle lanes and micro-mobility options will create jobs and business opportunities by connecting new areas of the city, promoting social inclusion and access to economic opportunities. To encourage a shift toward micro-mobility bicycle lanes should aim to connect areas affected by urban poverty and unplanned settlements, and be designed for safety and accessibility in mind. Awareness campaigns and training programmes aimed at women, youth, and the elderly should be organised to promote safe use and reduce accidents. Collaborations with women's cooperatives and youth initiatives for micromobility parking and sharing stations can enhance local ownership and economic inclusion. Monitoring of the impacts of the action should include gender-disaggregated data, covering age, disability, and income, to evaluate how well micromobility systems serve diverse groups and guide inclusive policy development.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Alternative modes of transport can build redundancy within the transport system and can be particularly helpful during disaster events or in case of disruption to the road, rail or metro infrastructure. Bicycle lanes must be designed keeping flood risk in mind.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – Increasing micromobility ridership can promote a shift away from private vehicle use, thus resulting in GHG emissions reductions. This reduction could be as much as 94% (accounting embodies carbon associated with bike sharing infrastructure) if the whole trip is taken by non-motorized transport. The GHG emissions reduction calculations assume that 0.5% of private vehicle (accounting for 17% of total trips in Bursa) users will shift to Non-motorised Transport/ active travel as a result of this action.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action includes a systematic integration of micro-mobility transport modes and expansion of the bike-sharing scheme. Opportunities to integrate location and capacity data into an app or service to inform the public about where bikes for hire are available should be explored. The bike-sharing system should also be integrated into the BursaKart payment network to make moving between public transport and micro-mobility easier encouraging greater uptake.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – The expansion of the city's bicycle network will result in integration between neighbourhoods and important activity points, especially in green areas/ecological areas. This will lead to improvements in recreation, tourism, health, well-being, and cultural ecosystem services.

Estimated annual NCV impact: €2,978,117

This action is likely to have positive impacts on the recreation ecosystem service. Ecosystem service impacts not valued, considering the 'top-down' valuation approach used for this Action.



Uludağ Cable Car



Both existing and new drivers should be trained to operate the new low-emission vehicle to facilitate a smooth transition across the whole fleet in the future.

2 EV CHARGING STATIONS AND REFUELLING INFRASTRUCTURE

The new buses will require the necessary infrastructure to facilitate charging, or refilling based on the chosen technology. A feasibility study to determine the optimum locations and number of required charging stations, or refilling stations, will be required. This should also include exploring the inclusion of solar PV and other renewable energy generation technology as part of depots and stations to further decarbonise operations associated with transport activities and supply the new buses with renewable energy.

3 BRT LANES

The TMP 2035 planned for a total of 50km of BRT routes to be implemented across the Province. This component comprises the implementation of one of the proposed routes within TMP 2035 as a pilot project, spanning 13 km between Geçit and Mudanya. This will help to connect the two areas with a low-emissions alternative public transit option and is aimed at reducing congestion along the road currently connecting these two population centres.

It is understood that this BRT route will be demarcated with road markings on existing roads rather than creating segregated lanes and associated infrastructure. This assumption will need to be confirmed during the detailed design after assessment of the current conditions along the 13 km route. Moreover, the number of stops and stations along the route should also be determined during detailed design and feasibility. Opportunities to facilitate denser urban development using transit-oriented development concepts, discussed as part of Action 3, should be explored when developing land uses around BRT stations.

The new Geçit and Mudanya BRT route and stations should be designed with high accessibility in mind, incorporating smart technology as well as NbS and SuDS in the design to build climate resilience as well as minimise surface water flooding and disruptions to services and infrastructure as a result of urban flooding.

Following the implementation of this BRT route, work should begin to plan and implement the

other 37km of BRT routes as a phased approach taking into account any lessons learned from the Geçit and Mudanya pilot project.

TIMELINES

COMPONENT 1:

0–9 MONTHS

Project preparation stage including, undertaking a feasibility and due diligence to assess what type of low-emissions technology should be prioritised and which route would work better for a low-emission bus fleet. This step includes the development of the project scope.

9–24 MONTHS

Procurement and commissioning of the new buses.

24–30 MONTHS

Piloting and testing the new fleet based on the feasibility assessment decisions.

30+ MONTHS

Monitoring of the new fleet and training the driver on low-emission vehicle operations.

COMPONENT 2:

0–12 MONTHS

Feasibility and due diligence on the charging/refuelling stations. This can be applied simultaneously with the Step 1 of Component 1.

12–24 MONTHS

Design and engineering of the charging/refuelling stations, including connection requirement, layout planning, and integration of renewable energy systems.

24–30 MONTHS

Procurement of construction and services including acquisition of charging/refuelling hardware and renewable energy technologies.

30–48 MONTHS

Construction and implementation of the charging/refuelling stations at determined points along the routes.

COMPONENT 3:

0–6 MONTHS

Development of stakeholder engagement plan to involve local authorities, operators for setting-up a coordination mechanism.

0–12 MONTHS

Feasibility and due diligence for the proposed BRT route.

12–24 MONTHS

Design and engineering of the BRT infrastructure, including BRT lanes, stations, traffic signals, junction rearrangements, etc.

24–30 MONTHS

Procurement of construction and services related to infrastructural requirements.

30–48 MONTHS

Construction and implementation BRT route, stations and all other infrastructural needs.

48+ MONTHS

Monitoring and evaluation of the BRT system performance to create long-term sustainability and optimisation.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Lack of capacity to implement, maintain and operate the system** may create technical risk.
- The **need to secure funding**.
- Need for **detailed design and route selection for BRT** to provide good coverage and appropriate services.



KEY STAKEHOLDERS

- **BMM Department of Transport** – Implementation agency – all components and steps.
- **BURULAS** – Implementation agency – all components and steps
- **District Municipalities** – Collaborate – all components and steps
- **Vulnerable population representatives (e.g., NGOs, civil society groups)** – Consult – all components and steps
- **General Directorate of Highways 14. Regional Directorate** – Collaborate – All components and steps
- **Universities and research institutions** – Consult – All components.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to transport management and operation of the bus fleet.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.
- **Climate financing** – from various programmes targeting climate mitigation and adaptation initiatives.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Direct revenue generation opportunities as a result of bus ticket fee collection, this should look to be digital integrated with the BursaKart.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action will generate new employment and business opportunities, particularly in operations, maintenance, and infrastructure management. The shift to new technologies will require training and skill development programmes which should be targeted to women and disadvantaged individuals where possible. Gender-sensitive retraining for drivers, inclusive procurement policies, and support for women in construction should be prioritised. New routes should look to improve access to essential services, like healthcare, childcare and green spaces. Buses and BRT stations should be designed with accessibility and safety in mind. Monitoring of the impacts of the action should include gender-disaggregated data, covering age, disability, and income, to evaluate how well micromobility systems serve diverse groups and guide inclusive policy development.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – As an additional and distributed mode of public transport, BRT systems can enhance the overall resilience of the transport system to disruption. BRT infrastructure should be designed taking resilience to flooding and heat into account. In addition, natural disaster risks, including earthquakes and landslides, should be considered for any design and route selection.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – By reducing the share of diesel buses within the bus fleet and replacing them with low-carbon alternatives, this action is expected to result in significant GHG emissions reductions. GHG emissions reductions will depend on the type of technology chose for the replacement buses and where their energy/fuel is derived from.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – New buses and BRT stations should include digital displays for dissemination of key information to passengers. The new buses and BRT should include technology to allow them to be easily integrated with the BursaKart system (see action 16). The new BRT buses should be linked up to a digital asset management platform to collect key data and help with the operation and maintenance of all the new assets.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.

84. TMP 2035



Acemler Junction

ACTION 16

Enhance operations of the transportation system through smart interventions

Setup an Integrated Traffic Management Centre and expand BursaKart coverage for all public transport modes.

RELEVANT THEMES

#transport

#digital

#sustainablemobility

#G&EI



Capital Investment (Project)



BURULAŞ



Bursa-wide



Planned and ongoing



Short (<2 years)



€ 350,000 Development/advisory costs
€ 5,750,000 Capital costs
€ 550,000 Operational costs (over 5 years)



Indirect Climate Resilience
Indirect GHG Emissions
Direct G&EI
Direct Smart
None NCV



ACTION 1 Develop a 'City Guide'

ACTION 13 Expand the metro / light rail network

ACTION 14 Develop micro-mobility infrastructure across Bursa

ACTION 15 Transition to a low-emission bus fleet with supporting infrastructure



Transport – Greater than 50% of public transit or micro-mobility trips are paid for by BursaKart.



7 – Affordable and Clean Energy

11 – Sustainable Cities and Communities

13 – Climate Action

This action seeks to implement a variety of smart solutions in the transport sector to enhance the operational efficiency and integration of different transport modes across the Province. This will help to improve energy efficiency, reduce congestion and lost time spent moving across Bursa City and the Province as well as positively contribute to GHG emissions reductions.

COMPONENTS

1 IMPLEMENTING SMART TRANSPORTATION SYSTEM WITH VARIOUS SMART SOLUTIONS⁸⁵

- Increasing the number of smart intersections;
- Ensuring traffic priority system in the modes of transportation meeting the requirements;
- Ensuring that updates, changes to schedules and any cancellations across all transportation modes, including, buses, ferries, trains, etc. are shared with citizens through digital channels without interruption; and
- Smart stop systems (with informative boards) to be operational throughout Bursa.

2 DEVELOP THE INTEGRATED TRAFFIC MANAGEMENT CENTRE

Develop the Integrated Traffic Management Centre with various smart traffic control systems based on the objective of 'Establishment of a Transport and Traffic Management Centre' in the TMP 2035. The centre will undertake management, control and routing operations to optimise traffic by applying smart traffic management system. This would include implementing:

- Central traffic computer hardware and software systems;
- Junction control devices;
- Detection sensors;
- Image acquisition and transmission systems (cameras); and
- Dynamic Message System (DMS) that can transmit all traffic data to drivers.

The Integrated Traffic Management Centre will help to improve efficiency and coordination between intersections helping to minimise unnecessary stops in traffic. Manage signal timings to reduce unnecessary interruption and oversee signal failures

will lead to swift reporting and maintenance of any issues. At junctions and along roads with high traffic congestion, signal programmes can be automatically changed based on conditions and time of day to facilitate smoother vehicle traffic flow. The centre will also allow for monitoring of dangerous intersections to avoid accidents. Moreover, the Centre should also ensure public transport vehicles, such as buses and trams, are prioritised at junctions.

3 EXPANDING BURSAKART COVERAGE

Expanding BursaKart coverage across all public transportation modes in Bursa, including, buses, metro, trams, and ferries, for both urban and rural areas. In addition, the BursaKart system should be integrated with the bike-sharing systems (Action 14). This integration has the potential to encourage a modal shift from private vehicles to public transport by simplifying payment methods, directly contributing to reduced traffic congestion and lower GHG emissions. Integration of other modes, such as the Bursa Uludağ Gondola as well as electric scooter operated by private companies, should be investigated.

TIMELINES

0–12 MONTHS

Undertake a City-wide assessment, including undertaking a holistic assessment to identify the key locations, roads and junctions for improvement and implementation of smart solutions.

12–24 MONTHS

Integrate smart solutions, including procurement and instillation of identified smart solutions and setting up the necessary infrastructure to link these up to the Integrated Traffic Management Centre and BursaKart.

12–24 MONTHS

Establishment of the Integrated Traffic Management Centre, including, setting up any necessary hardware and software, linking up junctions and transport networks into the Centre and coordinating between various public transport operators.

12–24 MONTHS

Expanding BursaKart coverage, by beginning to integrate the various transport modes into the network, this should continue into the future as new lines and networks are developed.

24+ MONTHS

Awareness raising and continued monitoring and evaluation, to inform the public of advantages and educate them on how to use the new system.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Difficulties in the integration of new smart/digital solutions to the existing infrastructure** may create technical risks.
- The **need to secure funding**.
- This action will also require the **coordination of a large number of stakeholders** which should be taken into account in its implementation.



KEY STAKEHOLDERS

- **BURULAŞ** – Implementation agency – all components and steps
- **BMM Transport Department** – Implementation agency – all components and steps.
- **General Directorate of Highways 14. Regional Directorate** – Collaborate – all components and steps.
- **District Municipalities** – Collaborate – all components and steps.
- **BMM Department of IT** – Collaborate – all components and steps.
- **Universities and research institutions** – Consult – all components and steps 1, 2 and 5.
- **Vulnerable population representatives (e.g., NGOs, civil society groups)** – Consult – all components and steps 1 and 5.
- **UKOME** – Collaborate – all components and step 1.
- **AYKOME** – Collaborate – all components and step 1



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to transport management.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Direct revenue generation opportunities as a result expanding the BursaKart coverage to a greater number of users and modes of transport.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The integration of smart/digital solutions across the transport sector within Bursa will enable real-time monitoring of traffic and public transport which will result in opportunities to increase safety measures. Additionally, real-time data monitoring will provide input for transfer and transportation solutions and planning that are tailored to the caregiving-related travel patterns of women. This action will also create various job across the sector, such as traffic management centre operators, real-time traffic monitors, data analysts, and software developers – digital upskilling of women and disadvantaged individuals should be considered to ensure equitable job opportunities. Expanding BursaKart coverage will provide passengers with simpler payment methods and create further opportunities to offer discounted tickets across various transport modes and the whole network for underserved and vulnerable groups. The creation/ widespread use of audio and visual information panels for disabled citizens in public transportation vehicles will also contribute to social inclusion.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The action should include disaster risk considerations and seek to use the new data collected and smart initiatives implemented to minimise the impacts of disasters, for example, helping to manage smart junctions to prioritise and facilitate better movement of emergency vehicles.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – Through enabling easier payments and transfers between public transport modes, this action can enable a shift away from usage of private vehicles, thus enabling GHG emissions reductions.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This is a 'smart' initiative for data collection and monitoring across the system and will result in increased efficiencies across the whole transport network.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.

85. https://eski.imo.org.tr/resimler/dosya_ekler/83148491c45c3fc_ek.pdf?tipi=79&turu=X&sube=7



Bursa Sea Buses (BUDO), Mudanya

Water

17

Ensure sustainable water use in green spaces

18

Implement use of alternative water sources in buildings

19

Ensure sustainable use of water resources in rural districts

20

Implement planned upgrades to municipal wastewater treatment plants





Çınarcık Dam, Orhanlı

Ensure sustainable water use in green spaces

Implement smart irrigation and alternative water systems in all BMM-owned green spaces.

RELEVANT THEMES

#water

#climate&environment

#resilience

#NBS

#NCV



Capital Investment (Programme)



BMM Department of Parks and Gardens



Bursa-wide



Ongoing and new



Short (<2 years)



€ 200,000 Development/advisory costs
 € 784,000 Capital costs
 € 39,200 Operational costs (over 5 years)



Direct Climate Resilience
Indirect GHG Emissions
Indirect G&EI
Direct Smart
Direct NCV - €694,058 annual NCV impact



None



Water – Reuse rate of alternative water sources is greater than 15%.



5 – Gender Equality
 6 – Clean Water and Sanitation
 11 – Sustainable Cities and Communities
 13 – Climate Action

Bursa is among the cities that are intensely experiencing the **impacts of climate change**. Rising temperatures and changing precipitation patterns driven by global climate change have increased the risk of disasters such as **droughts, floods, and overflows** in urban areas. To mitigate these risks and minimize their impacts, it is essential to transform existing infrastructure systems through the implementation of **innovative water management** technologies that align with climate change scenarios. According to the CORINE Land Use 2018 data, Bursa has approximately **400 hectares of green urban areas**⁸⁶. The city owns and manages a substantial amount of open green space; however, these areas are predominantly irrigated using water from the potable water network. The use of alternative water sources for irrigation remains minimal.

Effectively and sustainably managing urban water resources requires the adoption of sustainable water use strategies, such as **smart irrigation systems and the utilization of alternative water sources**. For instance, collecting rainwater runoff from impermeable surfaces during sudden and intense rainfall events and using it for the irrigation of urban green spaces can significantly help reduce the risk of flooding. Additionally, this approach can prevent pollutants carried by runoff from reaching rivers and lakes. Moreover, the reuse of treated effluent and greywater, for example, runoff from showers or car washes, for irrigating green areas should also be considered. When **integrated with smart irrigation technologies**, such practices not only conserve water but also contribute to achieving sustainable urban water management goals.

COMPONENTS

1 IMPLEMENT SMART IRRIGATION AND PROMOTE ALTERNATIVE WATER SOURCES FOR IRRIGATION

The **main component of this action is to implement smart irrigation and promote alternative water sources for irrigation of 70%, 280ha, of these green urban areas**. This assumes that some of the green urban areas will not be suitable for the implementation of smart irrigation, and newer green spaces developed over the past 3 years have already use drip irrigation. The action should be developed as a phased rollout of smart irrigation and the use of alternative water sources for BMM-owned green

space, starting with large open spaces, such as Reşat Oyal Kültür Park or Merinos Kültür Park. It should include provision for filtration and disinfection of water as well as ample storage tanks for storage of irrigation water for when it is needed most. Lessons learned from the implementation of smart irrigation in the Soğanlı Botanic Park should be assessed and used to inform implementation in other BMM-owned green spaces. In addition, efforts should be made to ensure drought tolerant plant species are used through BMM owned green spaced to minimise the need for irrigation, specifically during summer months.

Implementing this action will have a direct impact on addressing water scarcity and inefficiency in water use by promoting the application of modern irrigation technologies and sustainable water management practices. By integrating smart irrigation systems, which utilize sensors and automated controls to optimise water delivery, BMM-owned green spaces can reduce water consumption while maintaining lush, well-managed green areas. Furthermore, leveraging alternative water resources for irrigation, such as treated greywater or rainwater, will reduce reliance on freshwater sources, contributing to long-term water conservation. This action aligns with regional efforts to improve water use efficiency in both urban landscapes and agricultural practices, helping to mitigate the pressure on existing water resources and supporting the sustainable development.

New **Water Efficiency Regulation** in Türkiye, published in December 2024, focuses on improving water management across water-dependent sectors, with particular emphasis on optimizing water usage⁸⁷. The regulation mandates the adoption of water-saving techniques, monitoring systems, and planning at both local and sectoral levels, which supports sustainable water management in urban and agricultural areas. This action therefore aligns with the new regulation by investing in smart irrigation and using alternative water resources in BMM-owned green spaces by promoting the use of non-traditional water sources (such as rainwater and greywater) and encouraging to implementation of water-saving technologies.

TIMELINES

0–9 MONTHS

Feasibility analysis, necessary due diligence and site selection are necessary to identify the feasibility of the project, which BMM green spaces are suitable

for implementation and any necessary environmental studies. The assessment will also encompass key aspects such as **water source identification, regulatory compliance, and technology selection** to ensure a comprehensive and strategic evaluation.

9–15 MONTHS

Infrastructure design and integration into an existing network to plan rainwater harvesting, pipelines, storage facilities, and filtration systems for seamless integration with existing irrigation networks. This should also include a detailed assessment of investment, operational costs, and potential funding sources, including grants and/or private financing.

15–24 MONTHS

Procurement of construction services and implementation of infrastructure.

24+ MONTHS

Monitoring, evaluation and ongoing maintenance, including real-time monitoring systems to optimise performance and prevent inefficiencies. Additionally, it is necessary to involve stakeholders, including, municipal authorities, designers, and local communities, for sustainable implementation and long-term success.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Site selection** to determine the most appropriate BMM-owned green spaces which should have the new smart irrigation and alternative water systems implemented.
- **Need to evaluate environmental and social impact assessment** (ESIA) including the ecological benefits, potential risks, and public perception to ensure responsible water resource management.
- **Need to design the system with flexibility** for future upgrades and expansion based on technological advancements.
- **It is essential to ensure the system's sustainability** through periodic audits, designation of an operator, and provision of necessary maintenance to guarantee long-term water efficiency and reliability.



KEY STAKEHOLDERS

- **BMM Department of Parks and Gardens** – Implementation Agency – All Components and Steps.
- **BUSKI** – Collaborate - All Components and Steps.
- **District Municipalities** – Collaborate – Step 4.
- **Private companies** – Involve and collaborate– Steps 2.
- **Universities** – Involve and collaborate.
- **General public** – Inform - All Components



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to green space management.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Implementing smart irrigation and alternative water resource systems can provide cost savings and energy gains. By reducing reliance on potable water, BMM can lower their water costs, freeing up funds for other urban development projects. Additionally, it may reduce the need for water pumping and distribution, leading to energy savings by means of lowering electricity consumption.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – This action would result in improved access to and quality of public spaces, particularly in underserved neighbourhoods. Jobs created due to this action during the construction and green space maintenance phases should ensure equal access to women and disadvantaged individuals where possible.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Promoting the use of smart irrigation and alternative water sources will reduce the pressure on the potable water network and help to alleviate water scarcity.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – Efficient water resource management and alternative water use can indirectly reduce GHG emissions associated with energy-intensive extraction of surface or groundwater.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action focuses on implementing smart irrigation in BMM-owned green spaces to optimise water use and reduce wastage. These can help to monitor the volume of water used for irrigation and present opportunities for optimisation based on plant species present in the green space.



IMPACT ON NATURAL CAPITAL VALUE

Direct benefits – By addressing water scarcity and promoting efficient use of water, this action will enhance the value of services from the water ecosystem.

Estimated annual NCV impact: €694,058

This action is likely to have positive impacts on the water supply ecosystem service. Ecosystem service impacts not valued, considering the 'top-down' valuation approach used for this Action.

86. <https://corinecbs.tarimorman.gov.tr/corine>

87. <https://www.tarimorman.gov.tr/SYGM/Duyuru/313/Su-Verimlilik-Yonetmeligi-Yayimlandi>



Sadağı Canyon, Orhaneli

Implement use of alternative water sources in buildings

Implement systems for rainwater harvesting and reusing alternative water resources in existing and planned municipal and public buildings.

RELEVANT THEMES

#water

#buildings

#resilience

#NCV



Capital Investment (Programme)



BMM Department of Urban Planning and Development



Bursa-wide



New



Medium (2-5 years)



€ 330,000 Development/advisory costs
 € 1,460,000 Capital costs
 € 73,000 Operational costs (over 5 years)

Direct

Climate Resilience

Indirect

GHG Emissions

Indirect

G&EI

Direct

Smart

Direct

NCV - €694,058 annual NCV impact



None



Water – Reuse rate of alternative water sources is greater than 15%.



5 – Gender Equality

6 – Clean Water and Sanitation

11 – Sustainable Cities and Communities

13 – Climate Action

In Bursa, the Water Exploitation Index (WEI)⁸⁸ for 2023 was calculated as 42%. This ratio indicates that abstraction is not sustainable and points out potential extreme water scarcity. **Türkiye's WEI is around 20%. This value indicates that Bursa experiences high water stress compared to the country's average.**

It is predicted that the **gross water potential may decrease up to 50% in the period of 2041-2070 due to the impact of climate change in the Susurluk Basin that covers the majority of Bursa Province** according to climate change projections. In consideration of these anticipated impacts of climate change sustainable water use should be promoted to meet demands. One of the key strategies for sustainable water management is the utilization of alternative water resources. In response, the government has recently undertaken regulatory initiatives to support this approach.

On **March 11, 2025, the General Directorate of Vocational Services** under the **Ministry of Environment, Urbanization, and Climate Change** introduced an **amendment to the Planned Areas Zoning Regulation**⁸⁹. With this update, as of **January 1, 2026, the installation of rainwater harvesting and greywater systems** will become mandatory for **new private and public buildings** of certain types and sizes. Filtered rainwater will be required to be used for **garden irrigation and toilet flushing**.

The **rainwater harvesting system** will be mandatory for:

- Buildings located on plots **larger than 2000 m²**, alongside **rainwater storage tanks with a capacity of at least 7 m³**.
- **Private buildings** with a **roof projection area exceeding 1000 m²**.
- **Public buildings** meeting the same criteria.

The **greywater system** will be mandatory for:

- **Accommodation facilities** with more than **200 beds**.
- **Shopping malls** with a **construction area exceeding 10,000 m²**.
- **Public buildings** with a **construction area exceeding 30,000 m²**.

This regulatory framework reinforces and accelerates the implementation of alternative water systems in municipal and public buildings, making it a legal necessity rather than a voluntary sustainability effort.

In recognition of these new regulations, the components making up the action aim to promote the widespread adoption of alternative water resources in municipal, public, and private buildings across Bursa to enhance water sustainability and reduce dependency on conventional water resources.

COMPONENTS

1 IMPLEMENT A PROGRAMME FOR DEPLOYING WATER HARVESTING AND REUSE SYSTEMS IN EXISTING AND PLANNED MUNICIPAL AND PUBLIC BUILDINGS

Implement a programme for deploying water harvesting and reuse systems (e.g. rainwater, greywater and treated effluent) in existing and planned municipal and public buildings (including, BMM offices, libraries, recreational facilities, etc.). This includes building/site selection and feasibility studies, design and engineering works, procurement of equipment and contractors, full implementation of the system and testing, monitoring and long-term maintenance. An initial pilot of 10 public buildings, for example, BMM offices or hospitality buildings (with an assumed construction area exceeding 30,000 m²) should be undertaken as part of the action. The pilot will showcase best practice implementation across these buildings and could result in further expansions in the future. It should be noted that implementing greywater reuse systems will require a greater level of effort and investment to replace existing infrastructure.

Recent amendments to regulations include provisions to facilitate the implementation of this action. The incorporation of alternative water resources, such as greywater and rainwater, in public and municipal buildings represents a crucial step in endorsing public awareness of sustainable water use. Demonstrating sustainable practices through initiatives led by decision-makers will play a key role in encouraging the widespread adoption of these systems.

2 IMPLEMENT A PROGRAMME FOR DEPLOYING RAINWATER HARVESTING IN LARGE COMMERCIAL AND INDUSTRIAL BUILDINGS

This includes building/site selection and feasibility studies, design and engineering works, procurement of equipment and contractors, full implementation of the system and testing, monitoring and long-term maintenance. An initial pilot of 10 private buildings,

for example, large commercial or industrial should be undertaken as part of the action. Identifying an appropriate implementation and delivery model will be necessary, this could be in the form of loans or grants for implementation of such systems. The pilot will showcase best practice implementation across these buildings and could result in further expansions in the future.

Given one of the main challenges in the water sector in Bursa is the excessive water withdrawal of surface water by industries, these buildings could be the focus of the action. Industries, in particular textile and olive processing, use high amounts of water. Similar to surface water abstraction, 13% of industrial water use officially comes from groundwater resources in Bursa. There are indications that the actual use of groundwater is higher than the reported value due to the presence of unauthorized (illegal) wells and unrecorded abstraction values.

Reducing industrial dependence on groundwater is essential, highlighting the importance of promoting alternative water resources, such as rainwater harvesting, to ensure sustainable water management in industrial facilities. Industrial facilities typically have **large roof areas**, providing a significant **potential for rainwater collection**. Additionally, securing an operator to ensure the system's sustainability is generally easier compared to other building types. Moreover, as a **major industrial hub** with an **annual rainfall above the national average**, Bursa offers favourable conditions for the effective implementation of rainwater harvesting systems.

Several examples of implementation of similar systems exist in Bursa, including the **Panorama 1326 Bursa Conquest Museum**, an eco-friendly building incorporating sustainable design principles including rainwater harvesting, where collected water is treated and reused for landscape irrigation⁹⁰.

3 DEVELOP A MARKET STUDY FOR ALTERNATIVE WATER USES

A large quantity of greywater and treated effluent is produced by Bursa's WWTPs. This presents an opportunity to harness this water and use it in industrial processes. However, the first step of this would be to undertake a Market Study for Alternative Water Uses across the Province. This includes:

- Understanding the potential quantity and quality of all alternative water sources.

- Potential industries and customers who would be willing to use this alternative water and any standards they would require this to meet.
- Any necessary additional infrastructure needs to collect and undertake additional treatment of alternative water.
- Methods and model of distributing the alternative water, for example, new piped networks or water tanks.
- Potential costs, financial risks and benefits assessments.

TIMELINES

COMPONENTS 1 AND 2

0–12 MONTHS

Feasibility analyses, planning and site assessments should be conducted to identify suitable buildings, analyse water demand, and evaluate available alternative water resources. Technical and economic feasibility studies should then be undertaken to assess the viability of the system and its potential return on investment. Stakeholders, including municipal authorities, engineers (practitioners), environmental experts, and building managers should be engaged for their input and necessary approvals. Additionally, regulations should be reviewed to ensure compliance with water quality, safety, and building codes.

12–18 MONTHS

System design based on appropriate technologies should be prepared according to the feasibility results. This should also include the development of engineering designs for collection, storage, treatment, and distribution systems, followed by obtaining necessary permits and approvals.

18–24 MONTHS

Procurement and installation of the systems, including procuring equipment, hiring contractors, and making any necessary infrastructure modifications. Quality control and safety checks should be conducted before system activation.

24–30 MONTHS

Initial system testing should be performed to verify functionality and efficiency, ensuring compliance with water quality standards through laboratory testing and inspections. This should include training for operators on system operation, maintenance, and emergency protocols, and any adjustments made based on the test results.

30+ MONTHS

Monitoring and maintenance should be continuously carried out after the implementation of the systems.

COMPONENT 3

0–3 MONTHS

Potential stakeholders that could use alternative water should be identified and engaged, with surveys conducted to determine their specific water quality requirements.

3–9 MONTHS

Data collection and baseline assessment on the quantity and quality of alternative water resources should be performed, and relevant regulatory standards should be reviewed. The current infrastructure should be assessed to determine if upgrades or new systems will be needed for water treatment and distribution. The costs of additional treatment, infrastructure, and distribution should be estimated, while financial risks and benefits should be assessed.

9–15 MONTHS

Development of the market study for alternative water uses should be compiled into a comprehensive report, providing strategic recommendations for implementation and next steps.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Backup systems** would be needed to maintain a reliable backup plan with municipal water supply in case of system failures or low alternative water availability.
- **Legal and safety regulations**, to ensure compliance with national and local water quality, health, and safety standards for alternative water use.
- **Building Codes and permits**, including obtaining necessary approvals for system installations in municipal and public buildings.
- **Public Awareness and engagement**, including training building users on sustainable water use and encouraging their participation in conservation efforts.



KEY STAKEHOLDERS

- **BMM Department of Real Estate and Expropriation**
– Implementation Agency – all components and steps.

- **District Municipalities** – Collaborate and involve – all components and steps.
- **BUSKI** - Collaborate and involve – all components and steps.
- **Provincial Directorate of Environment and Urbanisation** - Collaborate and involve – all components and steps.
- **Other building owners** - Collaborate and involve – all components and steps.
- **Individual industries** - Collaborate and involve – in particular, component 2 and 3.
- **Universities** – Collaborate and Involve – in particular, component 3.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to sustainable building management (Component 1).
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES

✓ Yes

This action can create several cost-saving opportunities. By using rainwater, greywater, or treated effluent, buildings can significantly lower their reliance on potable water, leading to substantial cost savings from water bills. Additionally, reducing the discharge of wastewater into sewage systems by using alternative water sources could decrease the treatment costs for municipalities.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – This action will result in job creation during the construction and maintenance phases, which should be targeted at women and disadvantaged individuals where possible.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – By using alternative water sources and reducing reliance on potable water, this action enhances water security. Rainwater

and other systems should be climate-resilient, with storage to support dry periods.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – Efficient water resource management and alternative water use in buildings can indirectly reduce GHG emissions associated with energy-intensive extraction of surface or groundwater.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action will deploy new technologies to maximise the reuse of alternative water sources in municipal and other buildings across Bursa. Complex and large systems should be fitted with monitoring and sensor equipment, for example, to keep track of the amount of rainwater collected and used for various purposes. This will help to optimise the system.



IMPACT ON NATURAL CAPITAL VALUE

Direct benefits – By addressing water scarcity and promoting efficient use of water, this action will enhance the value of services from the water ecosystem.

Estimated annual NCV impact: €694,058

This action is likely to have positive impacts on the water supply ecosystem service. Ecosystem service impacts not valued, considering the 'top-down' valuation approach used for this Action.

88. Water Exploitation Index is a water scarcity indicator evaluating water stress as a result of human activities in terms of water abstraction

89. <https://meslekizmetler.csb.gov.tr/planli-alanlar-imar-yonetmeligi-guncellendi-haber-290883>

90. <https://panorama1326.com.tr/mimari-ozellikler/>

Ensure sustainable use of water resources in rural districts

Implement measures for reducing non-revenue water and improving efficiency of water use in rural districts.

RELEVANT THEMES

#water

#landuse

#resilience

#NCV

#climate&environment

#mitigation

#G&EI



Capital Investment (Programme)

BUSKI
DSI

Bursa – rural Districts



New



Medium (2-5 years)



€ 550,000 Development/advisory costs
 € 36,875,000 Capital costs
 € 1,100,000 Operational costs (over 5 years)

Direct

Climate Resilience

Direct

GHG Emissions - 1,750 tCO₂e/year

Direct

G&EI

Direct

Smart

Direct

NCV - €2,082,175 annual NCV impact



None



Water – Reuse rate of alternative water sources is greater than 15%.

Water – Non-revenue water in each district is lower than 26%.



6 – Clean Water and Sanitation
 11 – Sustainable Cities and Communities
 13 – Climate Action

Agriculture accounts for approximately 70% of water use in Bursa. This issue is further exacerbated by the limited adoption of resource-efficient irrigation technologies such as drip irrigation. Flood irrigation is the main method of irrigation used over an agricultural area of around 87500 ha with an average water use of 8000-10000 m³/ha. Efficient use of water in agriculture by means of modern irrigation techniques, for example, drip irrigation, is not currently undertaken at a considerable level. Around 33,000 ha of agricultural land is irrigated in this manner which uses water at an average of 3500-5000 m³/ha. The lack of widespread adoption of modern irrigation technologies contributes to significant water loss, exacerbating the existing pressure on already limited water resources. Consequently, agricultural irrigation places considerable pressure on the water resources of Bursa.

Traditional farming practices are predominantly favoured and implemented in the region. Suitable crop patterns applicable to the agricultural land in Bursa would benefit from being revised and updated keeping in mind the adverse effects of climate change on the water resources. This can only be maintained by the application of 'good agricultural practices', 'integrated pest and nutrient management' and 'appropriate crop selection and associated irrigation schedule'. Transitioning to modern agricultural techniques would benefit the region. Further cooperation between local farmers and Bursa Provincial Directorate of Agriculture and Forestry, the rural development agency active in the province and its neighbourhood Provinces, is needed to ensure the approval of such modern agriculture techniques.

To ensure sustainable rural development in the water sector, the non-revenue water (NRW) rate is also a critical issue that must be addressed. NRW is around 20% and existing data show that it has been decreasing year by year over the past 10 years. This ratio is lower compared to the national average NRW, which was around 32% in 2023⁹¹. In this context, activities have included forming pipe inventory, detecting leaks (using methods such as pressure monitoring, SCADA, etc.), and renewing pipes in poor condition. However, good conditions are only valid for the centre of the city. **The water loss rates are comparatively higher in the surrounding Districts.** NRW value is not equal across all Districts, it is observed that NRW in some Districts reaches up to 46%.

COMPONENTS

1 DEVELOP A BURSA PROVINCE NRW STRATEGY AND DROUGHT MANAGEMENT PLAN

An NRW strategy should be developed to identify where and what technology/intervention needs to be implemented in order to reduce NRW in areas where it is highest in Bursa, in particular focusing on rural Districts.

A drought management plan specific to Bursa is advised to be developed to understand and evaluate the full impact of climate change on water usage within the agricultural sector. The plan could encompass measures such as transitioning to drought-resistant cropping patterns, modifying irrigation methods, and replacing water-intensive crops with more suitable alternatives in water-critical regions.

2 IMPLEMENT A TARGETED PROGRAMME TO REDUCE NRW IN AREAS WHERE IT IS HIGHEST

Based on an NRW strategy a programme to reduce NRW in rural Districts and in particular in areas where NRW is more than double the average for the urban core (>45% in some Districts) should be implemented. The programme is advised to include; network and pipe renewal, leak detection sensors, etc., and it is advised to roll out the programme in a phased approach starting with a pilot project in a selected district—such as İnegöl (with an NRW ratio of 56%), Mustafakemalpaşa (55%), or Orhangazi (54%), based on 2023 data⁹².

3 IMPLEMENT SMART IRRIGATION AND SELECTION OF SUSTAINABLE CROP PATTERNS FOR FARMS

In Bursa, nearly 87,500 hectares of land are currently irrigated using flood irrigation systems. If this area were to adopt smart irrigation systems, it is estimated that around 27 million m³ (56%) of water used for irrigation could be saved annually. The component proposes to undertake a pilot programme to implement smart irrigation on 10% of this land, accounting for 8,750 ha. This can later be expanded in a phased approach to implement smart irrigation in the remaining 90% of the land across the Province. Awareness-raising activities and capacity-building for farmers to promote sustainable farming practices (including, selecting appropriate crop patterns for the

soil type, seasonal conditions, and water efficiency) with the goal of reducing water use in the agricultural sector should also be undertaken. This has the potential to increase crop yields and the productivity of farmland across the province in the face of climate change and therefore provide opportunities for enhancing their economic output. Identifying an appropriate implementation and delivery model will be necessary, this could be in the form of loans or grants for the implementation of such smart irrigation systems by private farmers.

TIMELINES

COMPONENT 1

0–3 MONTHS

Initial planning with a work plan and timeline should be established, and key stakeholders should be engaged to ensure coordinated planning and local input.

3–9 MONTHS

Data collection and baseline assessment, including the level of NRW, the condition of infrastructure and the vulnerability of rural areas to drought, should be assessed to identify priority areas.

9–15 MONTHS

NRW strategy and drought management plan should be developed, incorporating targeted interventions and climate-resilient agricultural measures, and finalized through expert and stakeholder review.

COMPONENT 2

0–6 MONTHS

Data analysis and identification of high NRW zones to identify the specific Districts with the highest NRW, and analyse the root causes (e.g. leaks, illegal connections, metering issues).

6–12 MONTHS

Determination of the most appropriate technologies and interventions to evaluate available technologies (e.g., smart meters, pressure sensors, SCADA, GIS) and plan their implementation in high NRW areas. Determine if further leak detection or pipeline renewal is required.

12–24 MONTHS

Pilot implementation – A pilot program should be identified and implemented in one of the rural Districts with the highest NRW rate.

24+ MONTHS

Full-scale roll-out across target rural Districts –

Based on the pilot results, expand the NRW reduction program across the identified high NRW areas by addressing leaks, replacing pipes, and upgrading meters and pressure monitoring systems.

24+ MONTHS

Monitoring and evaluation – Need to regularly monitor NRW levels in all Districts, analyse trends and identify any new issues that may arise.

COMPONENT 3

0–6 MONTHS

Developing a baseline understanding, this includes undertaking a comprehensive assessment of current water use and irrigation and agricultural practices, mapping private farms, soil types and seasonal conditions.

3–6 MONTHS

Develop a stakeholder engagement plan, including mapping stakeholders involved, in particular, private agricultural businesses to benefit from this action, and develop an engagement plan to keep them informed through action development.

6–18 MONTHS

Site selection, design and planning of Smart Irrigation Systems, this includes undertaking any necessary feasibility and due diligence studies.

18–36 MONTHS

Procurement and implementation, this could be run as a pilot for a few agricultural businesses and include the procurement of equipment and construction services to implement the smart irrigation systems.

36–40 MONTHS

Farmer Training and Capacity Building, including training on the selection of appropriate crops and implementation of modern agriculture techniques, etc.

40+ MONTHS

Monitoring, evaluation and further roll-out, to gather any lessons learned and implement when rolling out additional smart irrigation systems across other farms and agricultural businesses.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- In NRW works, specialized knowledge is required to operate and maintain advanced leak detection systems, smart meters, and pressure monitoring tools. **A skilled workforce will be essential** for the successful implementation and operation of these systems.
- **Training and increasing farmers' awareness** of water issues is of high importance for sustainable agricultural activities.



KEY STAKEHOLDERS

- **BUSKI** – Implementation Agency – all components and steps.
- **DSI** – Implementation Agency – all components and steps.
- **District Municipalities** – Collaborate and involve – all components and steps.
- **Irrigation union** – Collaborate and involve – all components and steps.
- **Provincial Directorate of the Ministry of Agriculture and Forestry** – Collaborate and involve – all components and steps.
- **Universities** – Collaborate and involve – in particular component 2.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to water management (Component 1).
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

By reducing NRW, water utilities can save operational costs related to water treatment and distribution, leading to increased profitability. Smart irrigation systems reduce water usage by applying water more efficiently, thereby potentially reducing irrigation costs. By optimizing water use, farmers can rotate crops more efficiently, reduce soil depletion and improve overall farm productivity.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action improves water use and access in underserved rural areas and will benefit small-scale farmers and low-income rural households. By increasing crop productivity through the use of smart irrigation technologies or use of drought tolerant crops, the program can boost food security and reduce poverty. These technologies also lower water use and energy costs, and can create rural jobs in maintenance, operations, and data monitoring, with technical training for youth reinforcing gender equality.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Implementation of improved irrigation and drought management measures will increase efficiency of water use and support building resilience to droughts and extreme heat. This is particularly important in the region as climate change is expected to reduce the availability of surface water resources.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – The shift from flood-based irrigation methods to drip irrigation will result in lower GHG emissions associated with water extraction. Moreover, there is further potential for reduction in NRW and therefore energy use associated with treatment of water.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The implementation of smart irrigation systems will help reduce the amount of water used for agriculture, collect data on water use, and help optimise the system to further reduce wastage of water.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – The implementation of smart irrigation systems will reduce agricultural water use, thus increasing the value from water supply and crop provisioning ecosystem services.

Estimated annual NCV impact: €2,082,175

This action is likely to have positive impacts on the water supply and crop provisioning ecosystem services. Ecosystem service impacts not valued, considering the 'top-down' valuation approach used for this Action.

91. <https://www.suverimliligi.gov.tr/en/urban-water-efficiency/> <https://www.buski.gov.tr/WebContent/Rapor/2023-faaliyet-raporu-.pdf>

92. <https://www.buski.gov.tr/WebContent/Rapor/2023-faaliyet-raporu-.pdf>

Implement planned upgrades to municipal wastewater treatment plants

Upgrade and complete the penultimate phases of existing WWTPs to enhance capacity, efficiency, and sustainability of wastewater treatment.

RELEVANT THEMES

#water

#industries

#resilience

#NCV

#G&EI

#climate&environment

#mitigation

#circulareconomy



Capital Investment (Project)



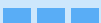
BUSKI



Bursa-wide



Planned and ongoing


 Long (> 5 years)


€ 750,000 Development/advisory costs
 € 77,229,000 Capital costs
 € 7,722,900 Operational costs (over 5 years)

Direct

Climate Resilience

Direct

GHG Emissions - 88,000 tCO₂e/year

Direct

G&EI

Direct

Smart

Direct

NCV - €3,470,292 annual NCV impact

**ACTION 17**

Ensure sustainable water use in BMM-owned green spaces

**ACTION 29**

Digital dashboard for air, noise, water and soil quality monitoring.

ACTION 30

Develop a 'River Depollution Roadmap' for the Nilüfer Stream

**Water** – 100% of the municipal population is served by a wastewater treatment plant.**Climate & Environment** – 100% of water from municipal WWTPs and industrial areas are covered by water quality monitoring equipment.**6** – Clean Water and Sanitation**11** – Sustainable Cities and Communities**14** – Life Below Water

Currently, Bursa performs relatively well in relation to sewerage and wastewater management. Sewerage services are provided to all District Municipalities of Bursa where almost 98% of the population have access to sewerage services. The proportion of the municipal population served by wastewater treatment is 89%, which is above the average value of Türkiye. It can be stated that 73% of the daily water withdrawal per capita in Bursa (203 L/capita/day) is discharged as wastewater (149 L/capita/day).

There are several centralised WWTPs across Bursa, the main two being the Eastern and Western WWTPs serving the majority of people across Bursa City which provide treatment in line with current laws and regulations. There are also a number of smaller centralised WWTPs servicing other urban centres across the Province, as well as a large number of package and natural WWTPs; these often only undertake physical and biological treatment of wastewater and therefore need upgrading with advanced treatment methods to comply with the latest laws and regulations. Table B1 lists the current WWTPs across Bursa alongside their current capacity and population served.

Despite this, pollution of water sources as a result of the discharge of partially treated effluent remains a challenge. In particular, this impacts surface and seawater quality with the Nilüfer Stream having some of the most polluted water in Bursa as it is exposed to partially treated domestic effluent as well as industrial and agricultural wastewater discharge. Moreover, the effects of human activities resulting in pollution of the Sea of Marmara are evident by the historic marine mucilage and algal bloom as a result of high nutrient levels caused by agricultural runoff and the discharge of partially treated effluent into the sea. Although the intensity of such events varies from year to year depending on various factors, a major event was witnessed in 2021 which sparked concern among local residents and authorities, a similar small event occurred in early 2025 as seen in Figure B9.

Efforts have been made to tackle this issue, including the creation of the Marmara Sea Action Plan (2022) developed as a 22-point Action Plan to clean up the sea. The plan was prepared in partnership with the Marmara Municipalities Union (of which Bursa is a member and holds the Presidency seat of the Executive Board) and the Ministry of Environment, Urbanisation and Climate Change. The plan includes emergency responses to clear

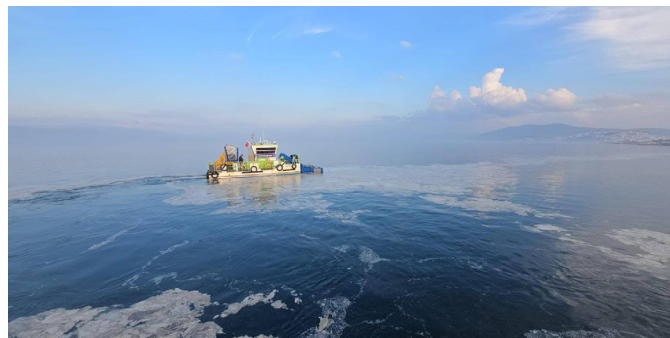


Figure B9: Mucilage problem on the coast of Bursa in January 2025

Source: BMM⁹³

marine mucilage blooms, stricter wastewater management, monitoring, and marine ecosystem restoration efforts. Moreover, as of 2021, the Sea of Marmara and the Princes Islands were designated as a 'Special Environmental Protection Area' by a decree from the Presidency of Türkiye.

Therefore, this action will invest in upgrading and undertaking penultimate phases of WWTPs across Bursa to accommodate additional capacity and advanced treatment in compliance with national legislation and revisions to the EU Urban Wastewater Treatment Directive. This is aimed at enhancing the quality of wastewater being discharged into the local environment and reducing water pollution. This could also result in the possibility of the enhanced treated effluent being used for irrigation of BMM owned green spaces as part of Action 17.



COMPONENTS

① DEVELOP A WASTEWATER TREATMENT AND BIORESOURCE STRATEGY

There are around 46 documented package WWTPs with a combined total capacity of more than 6,800 m³/day and 64 documented natural WWTPs with a combined total capacity of more than 7,300 m³/day. These are decentralised treatment plants servicing small communities and they are spread throughout Bursa Districts. However, the specific location and origin of wastewater treated at these packages and natural WWTPs is unknown. This action seeks to identify efficiencies, particularly through developing new integrated WWTPs. Links to the alternative water strategy should be drawn out as any new and combined WWTPs can supply alternative water sources for surrounding uses.

In parallel, this action aims to develop a Bioresource Strategy to streamline sludge management and identify infrastructure requirements for its reuse, treatment and safe disposal. This could include the expansion of the current sludge treatment infrastructure at the Eastern WWTP or the building of a new facility at a different WWTP. Opportunities to

WWTP	Home District	Current capacity (m ³ /day)	Population served	Current treatment processes.
Eastern WWTP	Osmangazi	240,000	1,476,444	Advanced biological treatment
Western WWTP	Nilüfer	87,500	429,603	Advanced biological treatment
Nilüfer WWTP	Nilüfer	12,000	12,439	Advanced biological treatment
Küçük Kumla WWTP	Gemlik	6,679	7,150	Advanced biological treatment
Kurşunlu WWTP	Gemlik	10,000	1,464	Advanced biological treatment
Akçalar WWTP	Nilüfer	4,561	10,655	Advanced biological treatment
Karacabey WWTP	Karacabey	8,500	63,371	Physical and biological treatment
Tirilye WWTP	Mudanya	N/A	N/A	N/A
Inegöl WWTP	Inegöl	130,000	N/A	Advanced biological treatment

Table B1: Current capacity and treatment processes for WWTPs in Bursa

Source: BUSKI

reuse the sludge should be explored where possible, including energy generation/recovery through anaerobic digestion and resold as nutrient-rich fertilizer to local farmers.

2 UNDERTAKE THE NECESSARY UPGRADES AND PENULTIMATE PHASES OF EXISTING WWTPS ACROSS THE PROVINCE

It is necessary to fund and provide technical assistance in expanding the existing WWTP as per BUSKI plans. This should also include any necessary infrastructure to support the tertiary treatment of wastewater in compliance with the revised EU Urban Wastewater Treatment Directive and ensure the highest quality of discharged wastewater; this could include additional treatment methods and equipment to remove excess phosphorus and/or microplastics from effluent. The prioritisation of investments needs to be undertaken by BUSKI in line with treatment requirements to meet international and national discharge standards, capacity and population studies conducted.

Some potential projects include:

- **Eastern WWTP** - This has been designed in two stages and has a capacity of **240.000 m³/day** for 2017 and **320.000 m³/day** for 2030. The treatment process consists of **pretreatment, biological treatment** (phosphorus, nitrogen and carbon removal and final sedimentation) and **sludge treatment**. For sludge disposal, there is a fluid bed sludge burning and energy recovery plant. This unit operates with a capacity of **400 tonnes of dry solids per day** and provides final disposal of sludge from all existing and future wastewater treatment plants. Feasibility studies for increasing the capacity of WWTPs should also take into account the possible expansion of the sludge-burning facility.
- **Western WWTP** - The average project flow rate is designed in two stages 87.500 m³/day for 2017 and 175.000 m³/day for 2030. The plant treatment process is based on the 5-stage (Phoredox) Bardenfo process.
- **Tirilye WWTP** - Needs to be planned and constructed with a capacity of up to 4,000 m³/day.
- **Nilüfer WWTP** - There are 2 phases of delivering the plant, first to serve 90,000 people by 2025, and the second stage to serve an additional undocumented number of people based on domestic populations in 2036. The detailed design of this expansion needs to be undertaken as part of this component.

- **Küçük Kumla WWTP** - Need to increase the capacity up to 12,000 m³/day. The detailed design of this expansion needs to be undertaken as part of this component.
- **Kurşunlu WWTP** - Need to increase the capacity up to an undocumented number. The detailed design of this expansion needs to be undertaken as part of this component.
- **Akçalar WWTP** - Need to increase the capacity up to 10,000 m³/day. The detailed design of this expansion needs to be undertaken as part of this component.
- **Karacabey WWTP** - Need to renovate the construction of the plant. The WWTP was established in 1993 and treats wastewater arising from the Karacabey District. The plant consists of a pre-treatment unit and aerobic and facultative lagoons. The detailed design of this renovation needs to be undertaken as part of this component.
- **İnegöl WWTP** - Need to renovate the plant. Operation responsibility belongs to the İnegöl OIZ Directorate. This WWTP was constructed for the treatment of wastewater coming from İnegöl OIZ and İnegöl District. The detailed design of this renovation needs to be undertaken as part of this component.

These should be complemented by any necessary auxiliary infrastructure. In addition, the implementation of on-site renewable energy generation, such as rooftop solar PV on offices or the potential for sludge to energy facilities informed by the bioresource strategy as part of Component 1, should be explored to promote renewable energy generation and decarbonise WWTP activities.

TIMELINES

COMPONENT 1

0–3 MONTHS

Stakeholder engagement and initial planning should be conducted to define objectives and key milestones for the strategy.

3–9 MONTHS

Baseline assessment should be completed to evaluate wastewater treatment systems and sludge management practices. **Data collection** should be initiated to identify locations and origins of wastewater treated at existing WWTPs.



Figure B10: Location of WWTPs to be upgraded

Source: AtkinsRéalis analysis

18–30 MONTHS

Integrated wastewater treatment and bioresource strategy should be developed, with infrastructure assessments and design plans for new or upgraded facilities.

COMPONENT 2

0–12 MONTHS

Feasibility Study and Planning to assess the existing situation of WWTPs, define upgrade scope, including additional capacity and treatment methods and equipment needed, estimate detailed costs, engage stakeholders, conduct environmental impact assessment studies, and secure regulatory approvals.

12–24 MONTHS

Design and Engineering to develop detailed engineering designs, select technologies, finalize technical specifications, and prepare financial and budget plans.

24–32 MONTHS

Procurement and Contracting, issue tenders, select contractors and suppliers, secure final funding, and obtain necessary construction permits.

32–48 MONTHS

Construction and Infrastructure Upgrades, implement civil, mechanical, and electrical works, install new treatment technologies, ensure quality control, and minimize operational disruptions.

48–54 MONTHS

Commissioning and Testing, conducting system testing, training staff, verifying compliance with regulations, resolving technical issues, and obtaining final operational approvals.

54+ MONTHS

Full Operation and Monitoring, start WWTP operations, implement real-time monitoring, conduct periodic maintenance, and optimize system efficiency.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- The planning of WWTPs should be conducted with consideration of future population projections to ensure **long-term capacity** and efficiency.
- WWTPs should incorporate advanced technologies and tertiary treatment that **enable the reuse of treated effluent**, promoting sustainability and resource conservation.
- Stakeholder engagement needs to be a major component of the action to inform the general public about ongoing work and avoid challenges and disruption to work.



KEY STAKEHOLDERS

- **BUSKI** - Implementation Agency – all components and steps.
- **District Municipalities** – Collaborate and be involved – in all components and steps.
- **BMM Directorate of Urban Planning and Development** - Collaborate and be involved – in all components and steps.
- **Universities** – Collaborate and involve – in particular component 1
- **OIZs** – Collaborate and involve - in particular component 2.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to water management (Component 1).
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Upgrading WWTPs to include technologies for treated effluent reuse could lead to the opportunity to sell recycled water to industries, agriculture, and municipalities.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – A programme of upgrading WWTPs will create job opportunities in construction, operation and maintenance, thus contributing to local economic growth. Policies to promote employment and retention for women in the male-dominated construction sector should be considered including during procurement. By ensuring more reliable wastewater treatment, the project can reduce disparities in access to this essential service across all parts of Bursa.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action improves the quality and quantity of treated wastewater released into the environment, thus reducing pollution and protecting riverine and coastal vegetation that act as vital buffers from storms and flooding. Upgrades and expansions of the WWTPs should consider climate and disaster risks during design.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – Upgrades to WWTPs include installation of renewable energy generation for WWTP operations, which will reduce the GHG emissions associated with wastewater treatment. GHG emissions reductions have been calculated as a 50% reduction in GHG emissions associated with the running of WWTPs if these are run on renewable energy sources.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The upgrade of operational components of each of the WWTPs should include installation of a SCADA system to gather real-time data and monitor and adjust operations to maximise efficiency. This can also help with monitoring wastewater discharge quality and ensure minimal impact on the local environment.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – The action will reduce the amount of partially treated effluent being released into rivers and ultimately into the sea, thus improving value of the water quality ecosystem service and indirectly enhancing value of recreation and fish provisioning due to the improved water quality.

Estimated annual NCV impact: €3,470,292

This action is likely to have positive impacts on the water supply ecosystem service, with additional benefits to recreation and fish provisioning. Ecosystem service impacts not valued, considering the 'top-down' valuation approach used for this Action.

93. <https://www.bursa.bel.tr/haber/buyuksehir-marmara-denizinde-musilaj-icin-calisma-baslati-35109>



Gemlik Wastewater Treatment Plant

Energy

21

Increase capacity within the Energy Efficiency Centre

22

Establish a heat recovery plant and district heating network

23

Expand biogas production capacity

24

Develop a floating solar farm





Merinos Atatürk Congress and Culture Centre

Increase capacity within the Energy Efficiency Centre

Enhance operations of the existing Energy Efficiency Centre (EEC) to serve as a 'one-stop-shop' for advice on energy efficiency.

RELEVANT THEMES

#energy #buildings #industries #G&EI
#energyefficiency #mitigation



Capacity-building / Awareness Programme



Energy Efficiency Centre (EEC) under BTSO



Bursa-wide



New



Short (<2 years)



€ 0 Development/advisory costs
€ 100,000 Capital costs
€ 495,000 Operational costs (over 5 years)



Indirect Climate Resilience

Indirect GHG Emissions

Direct G&EI

Indirect Smart

None NCV



ACTION 8 Implement sustainability and resilience interventions in BMM-owned buildings



ACTION 9 Deploy a low-emissions heating programme for residential buildings

Buildings – There is no use of coal for household heating.

Buildings – More than 50% of commercial and residential buildings have Energy Performance Certificates.

Energy – Number of electricity interruptions are less than 13 per year per customer.



7 – Affordable and Clean Energy

12 – Responsible Consumption and Production

13 – Climate Action

In Bursa in 2020 electricity and fuel use in industrial, residential, commercial and government buildings accounted for a combined share of 67% of all GHG emissions, around 10.74 million tons of CO₂e. Therefore, reducing energy consumption through the implementation of energy efficiency measures in buildings can be one of the best ways to reduce GHG emissions while also building energy resilience. However, there can often be a general lack of information and understanding of the type of technologies available and their means of implementation.

Currently, an Energy Efficiency Centre exists as part of BTSO. However, this centre faces resourcing and capacity challenges and does not operate at its full potential.

COMPONENTS

1 IMPROVE THE OPERATIONS OF EXISTING CENTRE TO ACT AS A 'ONE-STOP-SHOP' FOR CREATING AWARENESS, BUILDING CAPACITY AND OFFERING TECHNICAL ASSISTANCE AND ADVICE

The main component of this action is to improve the operations of existing centre to act as a 'one-stop-shop' for creating awareness, building capacity and offering technical assistance and advice for implementing measures relating to energy efficiency.

The centre should be provided with the necessary resources to provide the following technical assistance:

- **Conduct energy audits** – to advise and support people and businesses in undertaking an energy audit of their buildings and uses to better understand individual energy use and opportunities for implementing efficiency.
- **Consultancy services on choosing the most appropriate energy efficiency technology** – to help people and businesses identify which energy efficiency technology and solution is best for them based on their resource availability, type and age of the building, etc.
- **What resources and guidance are available** – to point people and businesses in the right direction to obtain further information and connect them with potential suppliers and installers.
- **Support on filling in funding applications** – to assist people and businesses with applying for appropriate national and regional funds for implementing energy efficiency.

The focus of the advice should be on the following technologies:

- **Smart sensors and IoT devices** – these can monitor and optimise energy usage in real-time, ensuring efficient operation. Examples could include motion detection lights or smart climate control.
- **Renewable energy installations** – these can help to produce clean energy and offset GHG emissions, these include, for example, solar PV or small-scale wind turbines.
- **Low-carbon heating installations** – linked to Action 9, implementing alternative low-carbon heating technologies can help increase energy efficiency, reduce the reliance on fossil fuels and improve local air quality.
- **Methods for improved insulation** – this helps to reduce heat and energy loss in buildings and includes technology such as double-glazed windows, cavity walls and spray foam, glass wool or mineral wool insulation.

In addition, the centre should undertake the following awareness-raising activities:

- **Public campaigns and educational material** – designed for distribution using traditional and new media, including, TV, radio, print, web and social media, aimed at educating the public on the benefits of enhanced energy efficiency such as reduced energy bills and GHG emissions.
- **Workshops and seminars** – to promote knowledge sharing and best practices relating to energy efficiency measures.
- **Behavioural change programmes** – develop a programme that encourages individuals and businesses to adopt energy-efficient behaviours, such as turning off lights and appliances when not in use.

TIMELINES

0–6 MONTHS

Initial planning and research, to define the objectives and intended outcomes of the Centre, this could also include undertaking a rapid needs assessment of the target audience to understand what information is needed, and research into best practices and measures already implemented in Bursa and how further support could be provided to expand these further.

9–12 MONTHS

Develop services, programmes and awareness-raising material based on the initial planning and research.

12–15 MONTHS

Set up any additional necessary infrastructure, equipment and hire new staff, this could include leasing an office, buying new office equipment, hiring new staff, training and upskilling existing staff, etc.

15–24+ MONTHS

Begin offering the services and programmes and disseminate the awareness-raising materials to the general public and businesses in Bursa.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Capacity and skills of existing staff of the implementation agencies to provide the necessary technical assistance, awareness and capacity building as proposed by the action. This may require hiring new staff and specialists and/or providing training to upskill existing staff.
- It is important to reach the public when implementing these actions, and local authorities (neighbourhood leaders, site management) should be involved in this context.
- Appetite and uptake from the general public and businesses for obtaining technical assistance services.



KEY STAKEHOLDERS

- **Energy Efficiency Centre (EEC) under BTSO** – Implementation agency - all components and steps.
- **BMM Support Services Department** – Collaborate - all components and steps.
- **BEBKA** – Collaborate - all components and steps.
- **Universities, academics and researchers** – Involve and collaborate – all components and steps.
- **Ministry of National Education** – Involve and collaborate – all components and steps.
- **City Council** – Involve - all components and steps.
- **General public** – Inform and Consult – in particular step 1 and 4.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to awareness raising and capacity building.
- **Grant** – National government, IFIs (for project preparation) and development organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Training courses offered by the Centre may be provided for a fee.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Enhancing access to information and technologies for groups most affected by energy poverty, such as, low-income households, women, the elderly, and small businesses, can deliver key social benefits. An Energy Efficiency Centre acting as a “one-stop shop” can help with sharing knowledge, reduce digital and economic inequalities by offering technical assistance and while green job training for women and youth will support equal participation in upskilling opportunities.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Increased awareness and capacity relating to energy efficiency can help build an understanding of the impact of energy use on the climate. Any energy efficiency actions implemented by the public and businesses due to this action can help build resilience against electricity interruptions as a result of climate and disaster hazards.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – Technical advice provided under this action will help identify routes for energy efficiency in buildings and therefore contribute to lower energy consumption and associated GHG emissions.



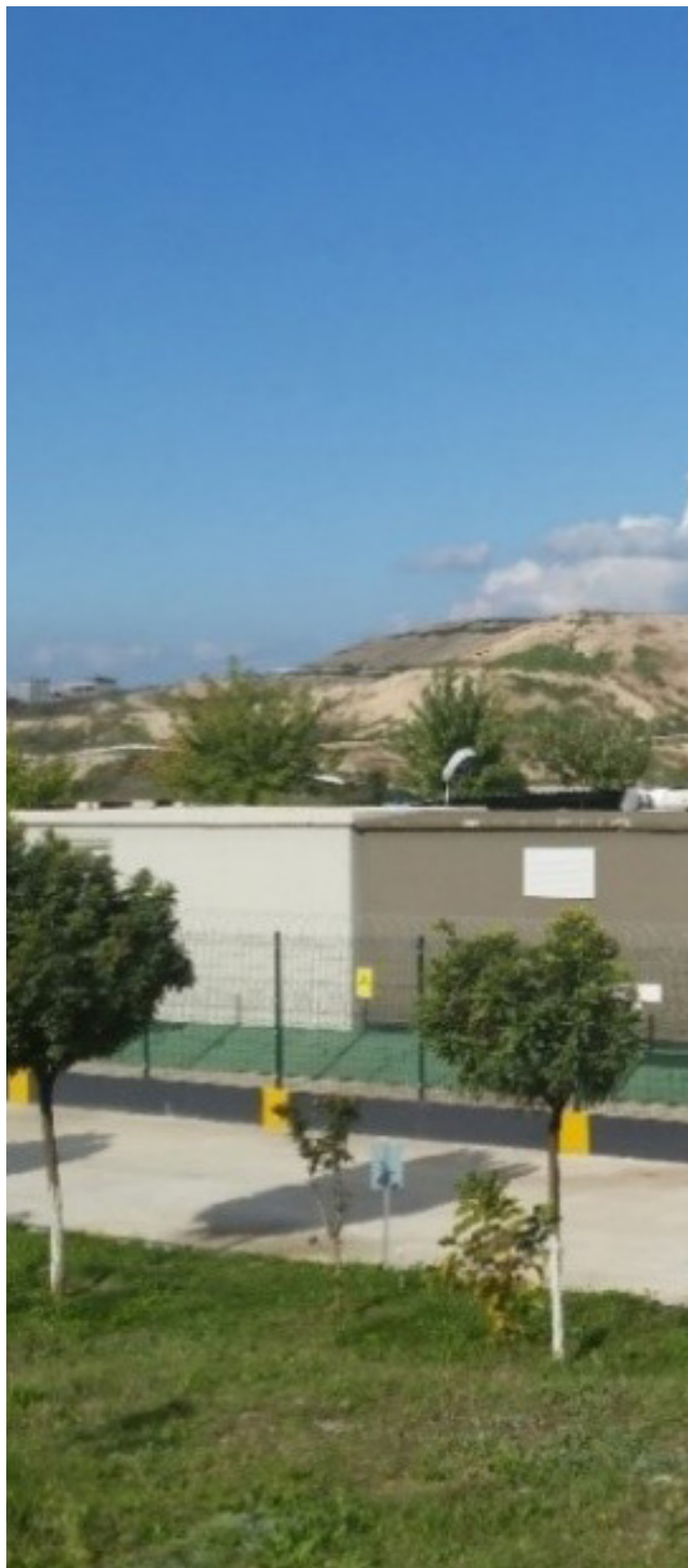
SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – This action will help build awareness around smart technologies that can be implemented to increase energy efficiency such as LEDs, smart sensors and other IoT devices, solar panels, and heat pumps.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.



Yenikent Methane Gas Energy Production Facility



Establish a heat recovery plant and district heating network

Retrofit the Ovaakça Natural Gas Combined Cycle Power Plant to recover heat and develop an accompanying district heating network.

RELEVANT THEMES

#energy #buildings #industries #G&EI

#energyefficiency #mitigation

	Capital Investment (Project)
	EUAS
	Ovaakça Natural Gas Combined Cycle Power Plant in Osmangazi District and surrounding settlements.
	New
	Long (> 5 years)
	€ 500,000 Development/advisory costs
	€ 25,000,000 Capital costs
	€ 2,500,000 Operational costs (over 5 years)
	Direct Climate Resilience
	Direct GHG Emissions - 32,300 tCO ₂ e/year
	Direct G&EI
	Direct Smart
	None NCV
	ACTION 3 Undertake urban redevelopment along planned metro lines
	Energy – Share of renewable energy use in total energy consumption is greater than 50%.
	Buildings – There is no use of coal for household heating.
	5 – Gender Equality
	7 – Affordable and Clean Energy
	12 – Responsible Consumption and Production
	13 – Climate Action

Fuel use for energy and heating in buildings is one of the main sources of GHG emissions in Bursa. District and central heating systems are employed in only 1 in 10 buildings despite national regulation mandating buildings larger than 2,000 m² need to be fitted with such heating installations. Moreover, there are several opportunities to retrofit existing infrastructure, including large-scale natural gas power plants, to harness heat energy and distribute it across a district heating network.

Therefore, the aim of this action is to enhance energy efficiency and provision of low-carbon heating by recovering waste heat from the Ovaakça Natural Gas Combined Cycle Power Plant and utilising it to develop a district heating network for buildings, including, industrial, residential, and commercial and public buildings. This will help to reduce GHG emissions as a result of fuel used for heating in buildings, lower energy costs, and provide a reliable source of heat for buildings in the local area.

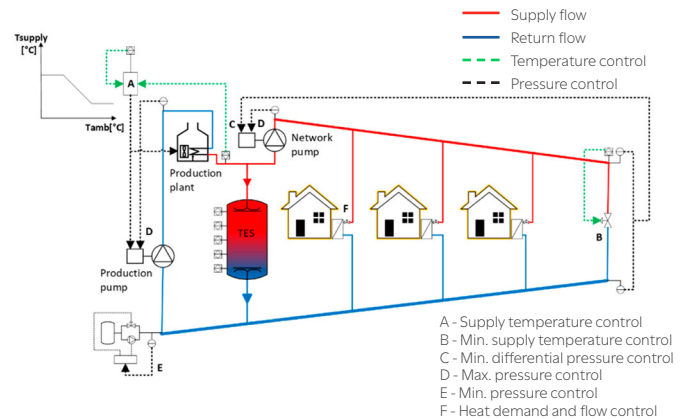


Figure B11: Conceptual diagram of heat recovery and district heating network

Source: Buffa et al, 2021⁹⁴

COMPONENTS

1 RETROFITTING THE OVAAKÇA NATURAL GAS COMBINED CYCLE POWER PLANT TO HARNESS HEAT ENERGY

It is understood that the Ovaakça Natural Gas Combined Cycle Power Plant is a closed cycle system where steam could be siphoned off from one of the 4 heat recovery steam generators to recover heat energy. Moreover, the plant is understood to operate on an intermittent basis based on grid demands and therefore the design of the system will need to include a backup for times when the plant is not operational or additional heat is needed. This back-up system should look to use sustainable and low-carbon energy sources

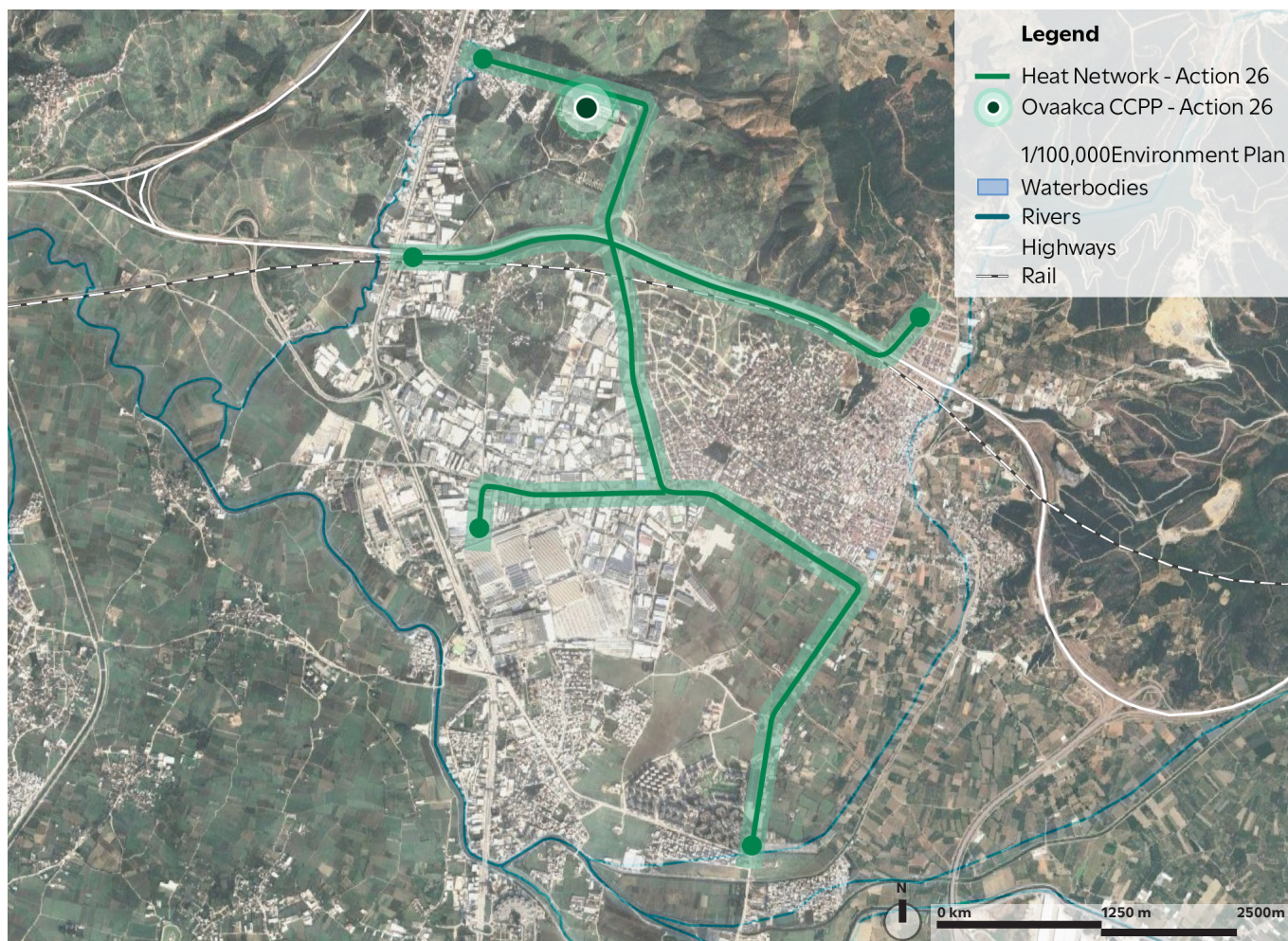


Figure B12: Map of potential district heating network

Source: AtkinsRéalis analysis

to maintain the carbon neutrality of the system, for example, green hydrogen biomass pellets or biogas produced from local anaerobic digestion facilities.

This heat would be distributed in the district heating network developed as part of component 2. Approximately 20 Mega Watts of heat energy would be needed to supply 10,000 average-sized residences. Although this may lead to a small reduction in electricity generation, any monetary losses would be offset by the provision of heat energy sold back to customers and buildings in the surrounding area.

2 DEVELOPING A DISTRICT HEATING NETWORK

The area surrounding the Ovaakça Natural Gas Combined Cycle Power Plant is home to several large industrial buildings, found in the Demirtaş OIZ, as well as residential, commercial and public buildings in Alaşarköy. The area is also expected to experience increased development in the coming decade given the expansion of the Çalı-Demirtaş Metro (as part of Action 13) as well as proposals to initiate urban redevelopment in the local areas (as

part of Action 3). This presents the opportunity to provide new buildings with a connection to the district heating network. The action should also offer existing customers and buildings in the local areas opportunities to upgrade their heating installations and connect to the district heating network.

As shown in Figure B12 a network servicing the surrounding area could stretch for around 20 km and could be developed in phases incrementally increasing the network's extent over the coming decade. This would comprise of laying insulated piping to transport heat energy from the recovery unit at the power plant to the buildings in the surrounding area as well as heat exchangers to transfer heat from the central system to individual buildings.

With the network infrastructure in place renewable or waste heat-based generation could be introduced to the system in line with the EU definition of efficient district heating and cooling as defined in the 'Energy Efficiency Directive' and provides a pathway to fully decarbonised district heating and cooling systems by 2050.

TIMELINES

0–3 MONTHS

Develop a stakeholder engagement plan to identify key stakeholders and engagement activities with the aim of keeping stakeholders and the general public informed through the development of the action.

3–12 MONTHS

Undertaking detailed design, any necessary due diligence and feasibility studies, and identifying the most appropriate delivery model and partner, this should also include obtaining any necessary planning and construction licences and renewable energy generation licences.

12–30 MONTHS

Installation of equipment and construction of district heating network, beginning with the retrofitting of the Ovaakça Natural Gas Combined Cycle Power Plant and developing a single section of the district heating network as a first phase (this could be the line directed to the Demirtaş OIZ offering heat to large industrial buildings and customers).

30–36 MONTHS

Testing and commissioning, to conduct thorough testing of the recovery system and district heating network to ensure these operate efficiently and safely, this would also include training staff to operate and maintain the system and network.

36+ MONTHS

Monitoring, evaluation and optimisation, to continue observation and monitoring of the system undertaking maintenance work and optimising the system.

36+ MONTHS

Begin the design and feasibility for any penultimate phases of the district heating network.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Securing enough customers and connections between the district heating network and buildings to ensure the economic viability of the action.
- The need to balance heat energy and electricity generation from the Ovaakça Natural Gas Combined Cycle Power Plant to ensure economic viability and to ensure continuous operation through a back-up system

run on low-carbon fuels as it is understood the power plant does not operate 24h a day.

- Extensive stakeholder engagement will be key as developing the district heating network will likely cause disruption during construction.
- Careful consideration and design to avoid creating a pathway that makes it difficult and expensive for the heat recovery system to move away from fossil-fuel use as the primary heat source in the future.



KEY STAKEHOLDERS

- **EUAS** – Implementation agency – all components and steps.
- **Ministry of Energy and Natural Resources** – Collaborate and involve – all components and steps.
- **BEBKA** – Collaborate and involve – component 2 and steps 2, 3 and 6.
- **BMM Department of Environmental Protection and Control** – Involve – all components and steps.
- **Provincial Directorate of Environment, Urbanization, and Climate Change** – Consult – all components and steps.
- **The general public and surrounding building owners** – Inform and consult – all components and steps.



POTENTIAL FUNDING AND FINANCING SOURCES

Will depend on the delivery model chosen, but could include:

- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.
- **Climate Finance** – For example, the Climate Finance Acceleration or Climate Investment Fund.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Potential to bill customers for the use of heat energy distributed through the network.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – District heating can reduce energy

poverty by providing cleaner, more reliable heating. It also presents opportunities to reduce reliance on coal, improving air quality and living conditions, particularly for vulnerable groups. Construction and operation of the district heating network will create employment opportunities. Procurement requirements, skill development initiatives and suitable policies should be implemented alongside this action to promote employment and retention of women, youth, and underserved groups.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Recovery of heat and distribution through a district heating network will help to diversify energy sources and build energy resilience.



IMPACT ON GHG EMISSION REDUCTION

Direct benefits – This action will offset the need for individual household natural gas use for heating. The GHG reduction has been calculated assuming the heat recovery plant and heat distribution network will supply 10,000 homes with an average size of 102.3m² and a heat energy demand of 107.85 kWh/m²/year (based on Türkiye averages).



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action offers opportunities to apply smart sensors and IoT devices to monitor temperature, flow and pressure within the system. This data can be used to optimise heat recovery and distribution across the network. A SCADA system should be integrated into the action to provide further opportunities for improved management and efficiency of the system.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.

94. Buffa, S., Fouladfar, M.H., Franchini, G., Lozano Gabarre, I. and Andrés Chicote, M. (2021). Advanced Control and Fault Detection Strategies for District Heating and Cooling Systems—A Review. Applied Sciences, 11(1), p.455. doi:<https://doi.org/10.3390/app11010455>.

Expand biogas production capacity

Expand biogas production capacity at the existing Eastern İnegöl Integrated Solid Waste Facility.

RELEVANT THEMES

#energy

#solidwaste

#mitigation

#TOD

#energyefficiency

#circulareconomy



Capital Investment (Project)



BMM



İnegöl District, Eastern Region Integrated Solid Waste Disposal Facility.



Existing and new



Medium (2-5 years)



€ 250,000 Development/advisory costs
 € 150,000,000 Capital costs
 € 15,000,000 Operational costs (over 5 years)



Direct Climate Resilience
Direct GHG Emissions - 4,200 tCO₂e/year
Indirect G&EI
Direct Smart
None NCV



ACTION 28 Implement the Western Regional Integrated Solid Waste Disposal Facility



Energy – Share of renewable energy use in total energy consumption is greater than 50%.

Solid Waste – Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.

Industries – The proportion of non-hazardous industrial waste that is reused or recycled is greater than 80%.



7 – Affordable and Clean Energy
12 – Responsible Consumption and Production
13 – Climate Action

As a key hub for agriculture and food industries, Bursa has a high rate of biomass and organic waste production and therefore potential for biogas production to be used for energy generation, heating of homes and transport. Vegetable and crop waste has the biggest biomass energy potential with a potential capacity of 6,750 GWh, animal waste from the agriculture sector, including cattle, poultry and other farm animals, has the potential to produce more than 1,500 GWh, while municipal waste has the potential to produce just over 1,700 GWh⁹⁵. Despite this potential, there are only 5 biogas power plants in Bursa with biogas accounting for only 1% of energy generation capacity in the Province. Biogas is also considered to be a carbon-neutral fuel source and therefore could be key for Bursa to continue decarbonisation of their energy and fuel use.

Therefore, this action seeks to expand the biogas production capacity at the existing Eastern Regional Integrated Solid Waste Disposal Facility as well as implement mechanisms which will help with the collection of biomass material from farms, municipal buildings and facilities such as markets, bazaars and restaurants.

COMPONENTS

1 EXPANSION OF BIOGAS PRODUCTION AT THE EXISTING EASTERN REGIONAL INTEGRATED SOLID WASTE DISPOSAL FACILITY AND FACILITATING BIOMETHANE PRODUCTION

The existing Eastern Regional Integrated Solid Waste Disposal Facility is home to a biomethanisation plant with an average production rate of around 6.1 million m³/year of biogas, and 13,600 MWh/year of electricity. Given these production rates, it is estimated the plant consumes around 13,500 tons of dry solids per year and has an average electricity production to gas production ratio of 2.1 kWh/m³ of biogas.

As part of the action, it is proposed to **install a second biomethanisation plant with a similar capacity** at the integrated facility. This would be **doubling the potential output of the plant to over 12 million m³/year of biogas production and 28,000 MWh/year of electricity**.

Moreover, the new biomethanisation plant should have the necessary infrastructure, including, purification, compression and distribution, to allow for biomethane production to be used as fuel for various public vehicles, including buses, solid waste transfer and collection vehicles, etc.

Any residual waste outputs (or digestate) from the biomethanisation process should be treated and resold as a nutrient-rich fertilizer to local farmers.

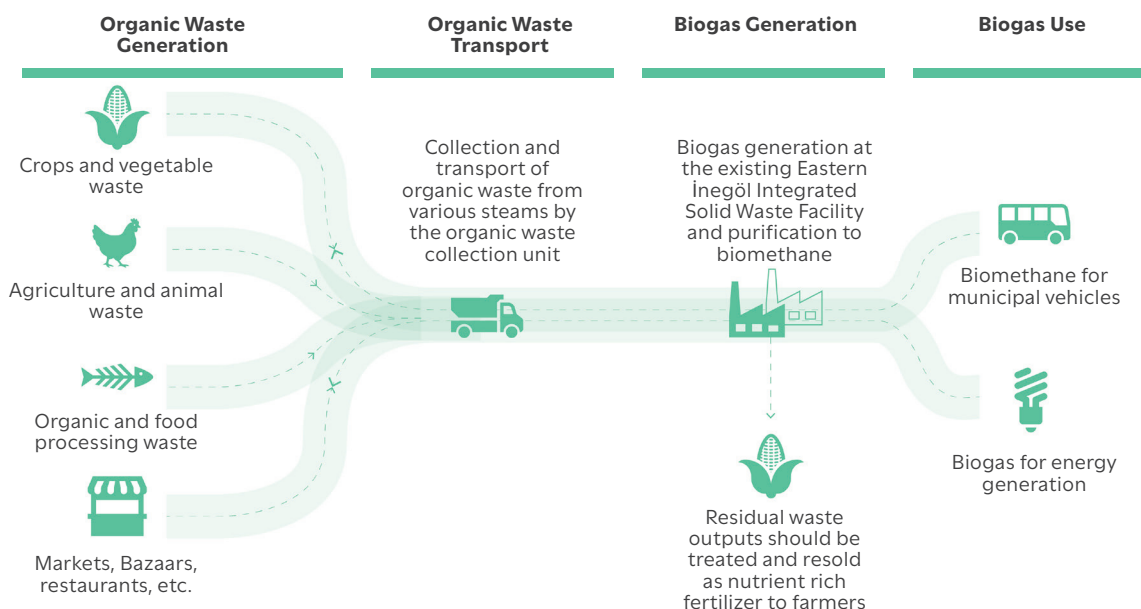


Figure B13: Conceptual diagram of organic waste collection and biogas/ biomethane generation

Source: AtkinsRéalis analysis

This will help to close the waste loop and generate additional revenue streams from the facility.

2 ESTABLISH AN ORGANIC WASTE COLLECTION UNIT

To facilitate additional biomass and organic waste supply for the expanded biomethanisation plant, an organic waste collection unit should be established by BMM. The unit will coordinate the efforts of organic waste collection from point sources, including, farmers and agricultural businesses, industrial and food processing and manufacturing companies, and municipal buildings and facilities, such as markets, bazaars and restaurants. **This will also include funding 5 dedicated vehicles for organic waste collection.**

It should be noted that Action 28 – Implement the Western Regional Integrated Solid Waste Disposal Facility would potentially also be home to a biomethanisation plant which could serve as another facility to drop off a process organic waste into biogas and biomethane.

TIMELINES

COMPONENT 1:

0–3 MONTHS

Develop a stakeholder engagement plan to identify key stakeholders and engagement activities to keep stakeholders and the general public informed through the development of the action.

3–18 MONTHS

Undertaking detailed design, any necessary due diligence and feasibility studies, this should

also include obtaining any necessary planning and construction licences and renewable energy generation licences.

18–24 MONTHS

Procurement of construction services and necessary auxiliary infrastructure.

24–48 MONTHS

Implement the new biomethanisation plant.

COMPONENT 2:

0–6 MONTHS

Establish the organic waste collection unit and begin to market the services to potential customers and clients.

6–9 MONTHS

Procure the new collection vehicles.

9–12 MONTHS

Begin operations of the unit collecting biomass and organic waste from various point sources and delivering it to the existing Eastern Regional Integrated Solid Waste Disposal Facility aiming to scale up operations as and when the new biomethanisation plant is delivered and in operation.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Site preparation and the potential need for acquisition of additional land** at the Eastern Regional Integrated Solid Waste Disposal Facility to accommodate a new biomethanisation plant.

- **Ability to collect enough biomass and organic waste** to ensure the new biomethanisation plant operates at full capacity.
- **Need to consider the management approaches of residual waste outputs** after biomethanisation, this could include treatment and resale as fertilizer.
- **Biomethane fuel standards** for use in vehicles as a consideration for necessary upgrades to the facility.



KEY STAKEHOLDERS

- **BMM** – Implementation Agency – all components and steps.
- **Private energy generation and distribution companies (EUAS, TEIAS, TEDAS and UEDAS)** – Collaborate and involve – component 1 step 2.
- **Ministry of Energy and Natural Resources** – Consult – component 1 step 2.
- **BMM Department of Environmental Protection and Control** – Consult – all components and steps.
- **District Municipalities** – Collaborate and involve – in particular component 1, steps 1, 2, and 3.
- **Tarım A.Ş.** – Collaborate and involve – in particular component 1, steps 1, 2, and 3.
- **BURULAS** – Collaborate and involve – all components and steps.
- **General public** – Inform and Consult – in particular component 1, steps 1, 2, and 3.
- **Private businesses (farms and agricultural businesses, and industrial and food processing and manufacturing companies)** – Consult – component 2 steps 1 and 2.



POTENTIAL FUNDING AND FINANCING SOURCES

Will depend on the delivery model chosen.

- **Own Source** – BMM budgets associated with solid waste management.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.
- **Public-Private Partnership** as stipulated by Law 3996.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Sale of renewable energy produced by biogas back to the grid and sale of biomethane to consumers as fuel for vehicles. Potential for collection of fees associated with drop off or collection of organic waste across municipal services, agriculture, industry and manufacturing.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Construction and operation phases of this action will create employment opportunities. Procurement requirements, skills development initiatives and suitable policies should be implemented alongside this action to promote employment and retention of women, youth, and underserved groups.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action helps to build energy resilience by expanding biogas and renewable energy production, which can provide an additional energy source during disruptions to energy supply.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – This action will result in GHG emissions reduction on account of the additional energy generated from biogas, often considered carbon neutral, therefore offsetting the energy use from the Turkish national grid which has a carbon factor of 309 gCO₂e/kWh/year⁹⁵.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action offers opportunities to apply sensors and smart mechanisms to control the temperature and pH balance within the biomethanisation plant to maintain a stable environment for microorganisms involved in anaerobic digestion. Automated feeding and loading of organic material into the plant could be implemented to optimise biogas production rates and avoid overloading the system. The plant should also be fitted with a SCADA system to manage operations based on real-time data which would result in improved efficiency.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – The action does not affect natural assets, ecosystems or the services they provide.

95. Republic of Türkiye, Ministry of Energy and Natural Resources, Türkiye Biomass Energy Potential Atlas, (2024), Available at: <https://bepa.enerji.gov.tr/> (Accessed: 22/07/2024)

96. UNFCCC Harmonized IFI Default Grid Factors 2021.



Rooftop solar on Bursa Natural Spring Water Treatment building

Develop a floating solar farm

Develop a floating solar farm and assess feasibility of battery storage and similar renewable energy facilities.

RELEVANT THEMES

#energy

#water

#climate&environment

#NCV

#energyefficiency

#mitigation



Capital Investment (Project)



BMM



Several potential locations, including Lake Uluabat, İznik or BUSKI owned irrigation ponds throughout Bursa.



New



Medium (2-5 years)



€ 900,000	Development/advisory costs
€ 7,600,000	Capital costs
€ 760,000	Operational costs (over 5 years)



Direct	Climate Resilience
Direct	GHG Emissions - 13,700 tCO ₂ e/year
Indirect	G&EI
Direct	Smart
Direct	NCV - €3,772,307 annual NCV impact



None

**Energy** – Share of renewable energy use in total energy consumption is greater than 50%.

6 – Clean Water and Sanitation
 7 – Affordable and Clean Energy
 13 – Climate Action
 14 – Life Below Water

Bursa Province is rich in renewable energy potential, including, solar, wind, hydro and biogas. Currently, around 28% of the generation capacity in Bursa is accounted for by renewable energy plants. However, only around 19.3% of total energy consumption in the Province is derived from renewables. The remainder share of the energy is derived from natural gas and coal. Ambitious plans at the national level to increase renewable energy generation to 50% of the country's energy mix by 2028, as stated in the 12th Development Plan, and reduce GHG emissions by 41% compared to 'business as usual' levels by 2030; efforts to establish further renewable energy plants need to be supported and increased at both national and local level.

Therefore, this action targets the development of new renewable energy plants on BMM-owned land or assets to help increase the share of renewable energy generation and consumption in the Province, reduce GHG emissions associated with energy generation and implement smart and new technology to build energy resilience.

COMPONENTS

1 FLOATING SOLAR FARM

The action proposes the implementation of a 10MW floating solar farm covering an area of around 0.2km², this would produce an estimated 50.4 million kWh/year^{97 98}.

There are several water bodies across the province which could be suitable for implementing a floating solar farm, including Lake İznik, Lake Uluabat or other irrigation ponds owned and operated by BUSKI. A high-level evaluation of each site has been undertaken by the Consultant Team and is presented in Table B2. However, further detailed studies to inform the site selection will need to be undertaken to ensure suitability and compliance with any national regulation or laws, in particular relating to environmental sensitivity and ecology given these waterbodies harbour many endemic and rare bird species and other aquatic flora and fauna.

Floating solar farms can harm aquatic ecosystems as a result of reducing surface area for oxygen to dissolve into the water and blocking sunlight penetration. Therefore, a detailed Environmental Impact Assessment will need to be undertaken, and mitigation measures implemented, for example investing in complementary restoration activities

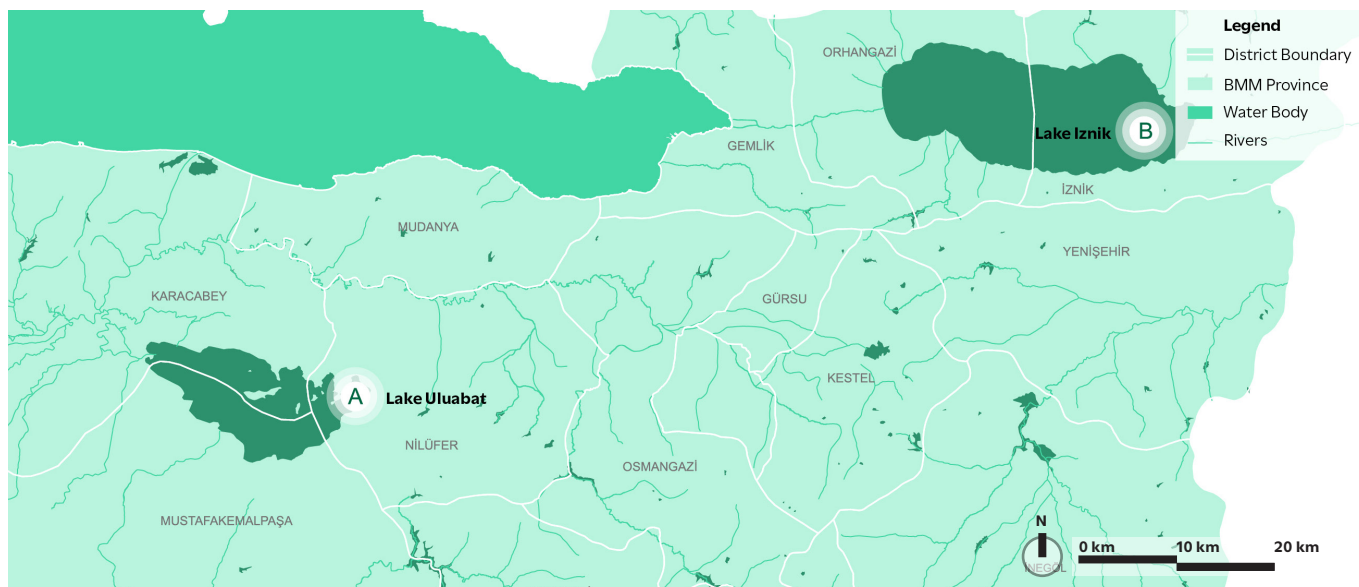


Figure B14: Map of potential sites for the floating solar farm

Source: AtkinsRéalis analysis

and nature-based solutions surrounding the water body, such as the creation of wetlands. Moreover, the floating solar farm should be designed to maximise power output across a minimal footprint to further reduce its impact on the aquatic ecosystem.

A – Lake Uluabat is spread across the Nilüfer, Mustafakemalpaşa and Karacabey Districts approximately 30km west of Bursa City. The lake is a large open body of water and covers an approximate area of 145 km². It is sheltered by mountains to its southeast and surrounded by agricultural land to its north, east and west. The lake is an important environmental asset and designated as a Ramsar Site, it is also home to the culturally significant Gölyazı settlement.

B – Lake İznik is spread across the Orhangazi and İznik Districts approximately 40km northeast of Bursa City. The lake is a large open body of water and covers an approximate area of 300 km². It is sheltered by mountains to its south and surrounded by agricultural land to its north, east and west. The settlement of İznik is found to its far east while the settlement of Orhangazi is found to its far west.

C – Irrigation ponds around Bursa are developed by DSI with ownership and operation later transferred to BUSKI and the Irrigation Unit. It is understood that there are more than 50 irrigation ponds across Bursa Province. Their exact size, location, proximity to energy infrastructure, such as substations and transmission lines, as well as geographic constraints and accessibility is unknown and therefore a detailed site selection study would need to be undertaken to determine a suitable location for the floating solar farm.

2 FEASIBILITY STUDY FOR A LARGE-SCALE BATTERY STORAGE PLANT

The plant could be integrated with the floating solar farm to store energy produced during the day and release it back into the grid when it is needed. Such a plant would help to balance energy demands as well as build energy resilience in case of disaster or emergency. The study should include site selection, choice of appropriate technology, procurement, delivery models and finance opportunities.

3 RENEWABLE ENERGY PLANTS ON BMM-OWNED LAND OPPORTUNITIES STUDY

BMM should explore further opportunities to utilise their land and assets for renewable energy generation. This would help BMM to increase renewable energy production and reduce GHG emissions. Therefore, an opportunities study should be undertaken to identify suitable locations, technologies, procurement, delivery models and finance opportunities.

TIMELINES

COMPONENT 1:

0–3 MONTHS

Develop a stakeholder engagement plan to identify key stakeholders and engagement activities to keep stakeholders and the general public informed through the development of the action.

3–6 MONTHS

Undertake a detailed site selection study to identify where the floating solar farm should be located, this

	A - Lake Uluabat	B - Lake İznik	C – Irrigation ponds
Water body instability	Medium	High	Low
Potential negative impact on aquatic ecosystem	High	Medium	Low
Potential negative impact on cultural/heritage assets	High	Low	Low
Distance to substation or transmission lines	Low	Low	Varied
Geographic constraints for accessibility	Low	Low	Varied

Table B2: Evaluation of potential sites for the floating solar farm

Source: AtkinsRéalis analysis

should take into account key constraints and potential impacts, such as ecology and impact on biodiversity, culture and tourism, water supply and resource availability, etc.

6–24 MONTHS

Undertaking detailed design, any necessary due diligence and feasibility studies, and identifying the most appropriate delivery model, this should also include obtaining any necessary planning and construction licences and renewable energy generation licences.

24–30 MONTHS

Procurement of construction services and necessary auxiliary infrastructure.

30–48 MONTHS

Implement the floating solar farm, this could potentially be implemented in a phased manner with expansions to the facility occurring beyond the 5-year GCAP planning period.

COMPONENT 2:

3–12 MONTHS

Undertake a feasibility study for the large-scale battery storage plant, this should include site selection and the possibility of co-locating the plant with the floating solar farm, policy and regulation review to ensure compliance, identifying the need for any due diligence and further studies, and identifying the possible delivery models, routes for procurement and funding.

COMPONENT 3:

12–24 MONTHS

Undertake the opportunities study additional renewable energy plants on BMM-owned land, this study should identify possible BMM-owned land which

could facilitate the development of further renewable energy plants including, solar, wind, hydro, biogas, etc., identifying the need for any due diligence and further studies, and identifying the possible delivery models, routes for procurement and funding.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Stakeholder engagement will be a key element** to keep the general public and relevant stakeholders, including the Ministries and energy generation and distribution companies, informed through the development of the action.
- **Close cooperation with energy generation and distribution companies** to facilitate collaboration and implementation of the action.
- **Site selection** will be key given the impacts of such a facility on aquatic ecosystems and the need for stable water environments.
- **Procurement for construction and delivery of the floating solar farm** may be a challenge as this is a relatively new and unexplored technology in Türkiye and therefore may require a specialist company to facilitate implementation of this action.
- **Potential lack of regulatory clarity** for new technologies such as floating solar farms and battery storage facilities. The process of obtaining the necessary licences and permits for the construction of these facilities should be well planned.



KEY STAKEHOLDERS

- **BMM** – Implementation Agency – all Components and Steps.
- **BUSKI** – Implementation Agency – all components and steps.
- **DSI** – Implementation Agency – all components and steps.

- **Ministry of Energy and Natural Resources** – Collaborate and involve – all Components and Steps.
- **Private energy generation and distribution companies (EUAS, TEIAS, TEDAS and UEDAS)** – Collaborate and involve – all Components and Steps.
- **Irrigation Union** - Collaborate and involve - in particular Component 1.
- **BEBKA** – Consult – all components and steps associated with site selection and feasibility.
- **BMM Department of Environmental Protection and Control** – Consult – all Components and Steps.
- **Provincial Directorate of Environment, Urbanization, and Climate Change** – Consult – all components and steps.
- **General public** – Inform and Consult – in particular Component 1, Steps 1, 2, 3, and 5, and Components 2 and 3.



POTENTIAL FUNDING AND FINANCING SOURCES

Will depend on the delivery model chosen, but can include

- **Own Source** – BMM budgets, or developer/operator's equity.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.
- **Climate Finance** – For example, the Climate Finance Acceleration or Climate Investment Fund.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Sale of renewable energy generated back to the grid

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The action presents opportunities for job creation during the development and construction phase, and initiatives such as inclusive procurement practices and training/ skill development should be considered to encourage women, underserved communities, vulnerable groups, and youth to fill these roles.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits - Floating solar panels can reduce evaporation of water from irrigation ponds and lakes, thereby increasing the availability of water for other

purposes. Moreover, large-scale battery storage and renewable energy plants will also enhance resilience in case of disaster by ensuring the continuous supply of renewable clean energy.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – This action is expected to reduce GHG emissions reduction due to the lower average carbon emissions factors associated with solar energy 37 gCO₂e/kWh/year⁹⁹ compared to the Turkish national grid 309 gCO₂e/kWh/year¹⁰⁰. GHG emissions reductions are calculated based on a 10MW floating solar farm covering an area of around 0.2km², this would produce an estimated 50.4 million kWh/year.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – As part of this action, new renewable energy technologies will be piloted and implemented, including floating solar and large-scale battery storage. This also presents opportunities to include enhanced real-time data collection, monitoring and operations through a SCADA system and integrating the floating solar farm and large-scale battery plant to enhance their operational efficiency.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – This action will directly contribute to enhancing the value of the renewable energy ecosystem service. In developing the new renewable energy plants, the selection of the sites should avoid areas of high natural capital value (e.g. woodlands) or protected/ irreplaceable habitats. Care should be taken to reduce the impact on the lake environment when implementing the floating solar farm. The floating solar farm may reduce recreation services if it prevents visitors from accessing parts of the lakes, , however, it could also reduce evaporation and increase water availability.

Estimated annual NCV impact: €3,772,307

This action is likely to have positive impacts on the renewable energy ecosystem service, with additional benefits to water supply. Ecosystem service impacts not valued, considering the 'top-down' valuation approach used for this Action.

97. <https://shura.org.tr/wp-content/uploads/2020/04/SHURA-2020-04-Rooftop-Solar-Energy-Potential-in-Buildings.pdf>.

98. Assuming a solar irradiance of 1,400 kWh/m²/year in Bursa and an 18% conversion rate.

99. <https://www.voltafan.com/index.php/2024/07/25/analysis-of-lifecycle-co2-emissions-from-various-electricity-generation-technologies/>

100. UNFCCC Harmonized IFI Default Grid Factors 2021.

Solid Waste

25

Improve performance through digital and governance initiatives

26

Improve waste segregation across the city

27

Enhance capacity and efficiency of waste transfer station network

28

Implement the Western Regional Integrated Solid Waste Disposal Facility





Eastern Region Integrated Solid Waste Disposal Facility

ACTION 25

Improve performance through digital and governance initiatives

Implement joined-up digital and governance initiatives to improve coordination, sustainability, and efficiency in solid waste management.

RELEVANT THEMES

#solidwaste

#digital

#circulareconomy



Data / Monitoring System
Capacity-building / Awareness Programme



BMM Department of Environmental Protection and Control.
District Municipalities.



Bursa-wide



New



Short (<2 years)



€ 50,000 Development/advisory costs
€ 115,000 Capital costs
€ 195,000 Operational costs (over 5 years)

None Climate Resilience

None GHG Emissions



Indirect G&EI

Direct Smart

None NCV

ACTION 12

Develop an industrial waste recycling facility

ACTION 26

Improve waste segregation across the city

ACTION 27

Enhance capacity and efficiency of waste transfer station network

ACTION 28

Implement the Western Regional Integrated Solid Waste Disposal Facility



Solid Waste – Proportion of total waste sent to landfill is less than 65%.



12 – Responsible Consumption and Production

In accordance with national legislation, different elements of solid waste management across Bursa are undertaken by different organisations. These include District Municipalities that collect household and municipal waste in their districts, private solid waste collection companies that collect specific waste streams like construction and industrial waste, and BMM who undertake the transfer, treatment and disposal of this various waste streams. The involvement of multiple entities in solid waste management presents barriers to the effective functioning of the sector. The distribution of responsibilities among various entities often makes implementing efficient measures for waste management, including collection, treatment and disposal) and recycling and reuse challenging. Data regarding industrial waste streams is not publicly available, which makes it difficult to plan suitable interventions around industrial waste. Moreover, it is difficult to consistently monitor illegal dumping of waste and unorganised landfill sites in rural districts, which continue to have a negative impact on the local environment.

Therefore, **this action aims to strengthen cooperation between stakeholders and organisations involved in solid waste management across Bursa** to foster better integration of services and reduce duplication of efforts, develop a digital solid waste management platform to help monitor and collate solid waste data as well as strengthen **monitoring, reporting and governance** across the sector but in particular relating to illegal dumping activities.

COMPONENTS

1 ESTABLISHING A WASTE TASKFORCE

A Waste Taskforce is suggested to be a committee of representatives and officials from the organisations involved in solid waste management in Bursa, including from BMM, each of the District Municipalities and private companies. This Taskforce should meet up regularly, for example, once a quarter, and focus on providing a platform for information exchange to help align activities and investment programmes, discuss important issues and challenges, and implement joined-up approaches to improve solid waste management across the city, including for example, informing the development of future solid waste management

strategies and investment programmes. In order to ensure consultations on the determination of penalties related to solid waste management, it may be appropriate to include the Municipal Police Department in the process among the relevant responsible units.

2 DIGITAL SOLID WASTE MANAGEMENT PLATFORM

Such a platform should use data and information from District Municipalities, private collection companies and BMM to help track, report on and improve solid waste management practices across the Province. The platform should store and present data relating to among others; the type and quantity of various waste streams collected in a given time period (including, waste from households and similar establishments (municipal solid waste), , municipal, industrial, hazardous waste, waste electrical and electronic equipment, construction and demolition waste, etc.); the quantity of waste transferred between facilities and waste recycled, treated, and disposed of within facilities in Bursa or other provinces. As part of this, a policy review and recommendations may be required to streamline monitoring, reporting, data collection and sharing.

3 STRENGTHEN MONITORING, REPORTING AND GOVERNANCE

Measures such as increased surveillance and regular inspection of areas prone to illegal dumping should be implemented, for example, drones could be used for regular aerial imagery to detect illegal dumping and monitor changes of uncontrolled dumping sites over time. Moreover, an app, or dedicated web page on the BMM website, should be developed to allow the general public to report any issues, such as illegal dumping activities or missed waste collections, overflow bins, etc., and provide them with best practices and information relating to reducing, recycling and reusing the waste they produce.

TIMELINES

0–3 MONTHS

Coordinate stakeholders and establish the Waste Taskforce to begin discussions of upcoming projects and facilitate information exchange.

3–6 MONTHS

Undertake a detailed review of existing monitoring,

reporting and governance measures in place and establish the need for enhancement, this could include, the purchase of new surveillance equipment, and drones or developing an enhanced mechanism to issue and enforce fines.

3–12 MONTHS

Develop the Digital Solid Waste Management Platform. Once the platform has been developed, assign a specific role within the Department of Environmental Protection and Control for a member of staff to undertake regular data collection, coordination and management of the platform.

3–12 MONTHS

Develop an app or dedicated web page on the BMM website for the public to access solid waste management services and information as discussed in Component 3.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Need for active and collaborative stakeholder engagement** to ensure the smooth setup and running of the Waste Taskforce.
- **Need to develop a comprehensive understanding of private solid waste collection companies**, including, their affiliated companies and existing relationships, waste streams collected, and existing treatment and disposal practices.
- **The capacity of the Department of Information Technology** to develop the necessary digital platforms and tools described might need the involvement of a specialised software development and coding company.
- It is important to ensure the participation of District Municipalities in all processes.
- Potential need for adjustments in legal provisions regarding waste tracking and reporting systems, consideration of waste catalogues and a database of registered waste service providers.



KEY STAKEHOLDERS

- **BMM Department of Environmental Protection and Control** – Implementation Agency – All Components and Steps.
- **District Municipalities** – Implementation Agency – All Components and Steps.

- **Private solid waste collection companies**
– Involve – All Components and Steps.
- **Tarım A.Ş.** - Involve and collaborate - All Components and Steps.
- **BURKENT** - Involve and collaborate - All Components and Steps.
- **BMM Department of Information Technology** – Involve and collaborate – Components 2 and 3 and Steps 3 and 4.
- **Provincial Directorate of Environment and Urbanisation** - Involve and collaborate – Components 1.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to solid waste management.
- **Grant** – National government, IFIs (for project preparation) and development organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

Although the action does not directly generate revenue, improved monitoring and control of illegal dumping will support environmental protection, while the enforcement of relevant penalties could lead to potential revenue growth for the BMM.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Awareness raising and capacity building activities as part of this action should be tailored to underserved and vulnerable groups and delivered in multiple formats to ensure it reaches a wide audience. Any skill development initiatives for this action could be designed to promote employment opportunities for women and disadvantaged individuals.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

No impacts



IMPACT ON GHG EMISSION REDUCTION

No impacts



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action already deploys several digital technologies to improve the management of the solid waste sector. Further smart features could involve integrating data from 'Internet of Things' (IoT) devices such as, bin fill level monitoring sensors installed in public bins, waste collection centres and recycling points, and utilising gathered data to optimise collection routes, reduce unnecessary pick-ups and improve hygiene.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.



Eastern Region Integrated Solid Waste Disposal Facility-Methane Gas Electricity Generation Facility

Improve waste segregation across the city

Facilitate the effective implementation of waste segregation programmes for all buildings and at strategic public open spaces.

RELEVANT THEMES

#solidwaste

#landuse

#buildings

#circulareconomy

#G&EI



Capital Investment (Programme)



District Municipalities (Main responsibility)

BMM Department of Environmental Protection and Control (Coordination)



Bursa-wide



Planned and ongoing



Short (<2 years)



€ 225,000 Development/advisory costs

€ 9,870,000 Capital costs

€ 2,470,000 Operational costs (over 5 years)

**Direct** Climate Resilience**Indirect** GHG Emissions**Direct** G&EI**Direct** Smart**None** NCV**ACTION 25** Improve performance through digital and governance initiatives**ACTION 27** Enhance capacity and efficiency of waste transfer station network**ACTION 28** Implement the Western Regional Integrated Solid Waste Disposal Facility**Solid Waste** – Recycling rates in each district is greater than 35%.**Solid Waste** – Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.**Solid Waste** – Proportion of total waste sent to landfill is less than 65%.**12** – Responsible Consumption and Production

Despite waste collection covering 100% of the Province and customers, there is currently very limited at-source segregation of municipal solid waste (i.e. waste from households and similar establishments such as public institutions, commerce etc.) across Bursa with dry recyclables and packaging waste only accounting for 2% of the total waste collected, organic waste accounting for 40.6% and the rest is considered general waste. There is also limited understanding of waste streams and generation across the industries sector which poses an additional challenge in ensuring proper waste segregation, recovery, recycling and reuse of waste. This is a missed opportunity for potential revenue generation as recovered waste materials could be sold to produce various recycled products. However, examples of good practices exist across the Province, including, existing recycling yards operated by District Municipalities, bins for source-separation deployed in municipal buildings as well as the presence of dedicated companies who sort and recycle waste. These efforts need to be expanded and better integrated into the solid waste management cycle.

Therefore, **this action is aimed at expanding existing waste segregation programmes to cover all buildings and strategic public open spaces to increase the ratio of recovered waste.**

COMPONENTS

1 FUND 10,000 NEW BINS FOR SOURCE-SEPARATION

Fund the implementation of bins for source-separation (organic and dry recyclables) for Municipal and public buildings, residential, commercial, office and industrial buildings, as well as strategic public open spaces, including parks, historic, cultural and tourism hotspots. This should also be linked with efforts in Land Use Actions and Transport Actions to support waste segregation as part of any new development.

2 FUNDING 50 MOBILE WASTE COLLECTION CENTRES AND 10 SITE-BASED COLLECTION CENTRES

Funding 50 mobile waste collection centres and 10 site-based collection centres ("recycling yards" or "civic amenity sites") – mobile waste collection can be strategically placed in public spaces, such as parking lots, to provide people with a drop-off point for



Figure B15: Examples of bins for source-separation and modular waste collection centres

Sources: (Left) AtkinsRéalis, 2024; (Right) ExpatMEDIA, 2024

various waste streams, including, clothing and textiles, electronic waste and batteries, garden and organic waste, plastics, glass, paper and other recyclables. Larger site-based collection centres should be located in easy to reach places and allow for people to access these by car to drop of larger waste items (bulky waste, construction and demolition waste, garden waste etc.). The mobile and site-based collection centres should be spread across the Province to ensure good coverage and access to people in both urban and rural District.

3 FUNDING THE PURCHASE OF 20 NEW COLLECTION VEHICLES

These should include vehicles of varying size to accommodate the various street widths in Bursa, including compact collection vehicles for narrow streets found in historic neighbourhoods. The collection vehicles should be dedicated to various waste streams to avoid cross-contamination.

4 DEVELOP AND CARRY OUT WIDE-REACHING AWARENESS-RAISING ACTIVITIES

Expand on existing awareness campaigns to ensure information dissemination across a wide geographic and socio-economic coverage. This could include targeted seminars and workshops in schools, universities, health institutions and businesses, activity days, physical and virtual advertising material, and social and traditional (TV and radio) media campaigns. This could also be linked to the new app or web page as part of the BMM website developed in Action 25.

Osmangazi District should be a target pilot District for the expansion of waste segregation programmes as similar activities are currently being

undertaken there. Moreover, the **District has a high concentration of waste generators**, including, municipal, residential, commercial and industrial buildings, and public open spaces and tourist attractions. There are **many locations where bins for source-separation and modular recycling points could be installed and collection vehicles deployed along narrow roads** in historic neighbourhoods.

TIMELINES

0-3 MONTHS

Establish coordination efforts with Osmangazi District Municipality and other District municipalities to organise the implementation of this action and obtain their buy-in.

0-6 MONTHS

Undertake the necessary project preparation activities, including, a site selection study to identify the strategic locations for implementation of new bins for source-separation, modular waste collection centres and recycling points, and feasibility for the purchase of new collection vehicles.

0-6 MONTHS

Develop wide-reaching awareness-raising activities to be run alongside the phased implementation of the action.

6-24 MONTHS

Procure and implement the 'Waste Segregation programme' in a phased manner implementing the bins for source-separation, modular waste collection centres and deploying the new collection vehicles across the Osmangazi District.

6–24 MONTHS

Carry out awareness-raising activities alongside the phased implementation of the action.

18–24 MONTHS

Monitor and evaluate the progress of the implementation of the action as well as awareness-raising activities and use the insight to roll out the programme to other District Municipalities.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- Need for effective cooperation between **BMM and District Municipalities**.
- Need for **appropriate building and site selection** for bins for source-separation and modular waste collection centres.
- **Uptake of waste segregation by the general public** could be low given current trends, however, these should increase with better awareness as a result of awareness-raising activities.
- **Ability to procure the necessary infrastructure, equipment and vehicles**.



KEY STAKEHOLDERS

- **District Municipalities** – Implementation Agency (main responsibility) – all components and steps.
- **BMM Department of Environmental Protection and Control** – Implementation Agency (Coordination) – all components and steps.
- **BMM Department of Parks and Gardens** – Collaborate and involve – components 1 and 2 and step 4.
- **BMM Department of Support Services** – Involve – all components and steps.
- **BEBKA** – Consult – component 1 and 2, and step 2.
- **Building owners and managers** – Involve and empower – all components and steps 4 and 6.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to solid waste management.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Increased at-source segregation will help to generate segregated waste streams and materials which can be sold and reused in other value chains, for example, recycled packaging, and cardboard and paper products can be sold and reused to create new materials.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action will result in improved access to solid waste management for all residents in the city. Separation of waste is likely to be disproportionately undertaken by women, which should be considered when designing the programme. Improvements in sorting and collection should consider impact on informal waste pickers, who are often migrants or belong to economically vulnerable households. Awareness and capacity building activities should be tailored to underserved and vulnerable groups and delivered in multiple formats to ensure it reaches a wide audience. An estimated 90 jobs may be created for operation of the programme – efforts to channel these employment opportunities to women and disadvantaged groups should be considered.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Effective segregation and collection of waste can reduce waste entering the drainage system during heavy rainfall events, thus mitigating impacts from flooding.



IMPACT ON GHG EMISSION REDUCTION

Indirect benefits – While the action does not directly target GHG emissions reductions, at-source waste segregation may result in lower trip generation, help optimise waste collection fleets and reduce operational GHG emissions of the waste management facility. Moreover, source-separation of biowaste prevents methane emissions at landfills and dry recyclables substitute primary raw materials.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action presents opportunities to implement IoT devices and sensors as part of the new segregated bins as well as modular waste collection centres. Installation of these devices in collection vehicles will present opportunities to optimise collection routes utilising real-time data. Moreover, data collected can also feed into the Digital Solid Waste Management Platform and inform future planning and investment activities while providing a clearer picture of waste management practices in Bursa.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide.



Eastern Region Integrated Solid Waste Disposal Facility

ACTION 27

Enhance capacity and efficiency of waste transfer station network

Build out planned waste transfer stations and carry out efficiency enhancements for existing transfer stations.

RELEVANT THEMES

#solidwaste

#industries

#mitigation

#circulareconomy

#G&EI



Capital Investment (Project)



BMM Department of Environmental Protection and Control. Tarım Peyzaj A.Ş.



Bursa-wide



Planned



Medium (2-5 years)



€ 400,000 Development/advisory costs
€ 1,470,000 Capital costs
€ 2,170,000 Operational costs (over 5 years)

Direct

Climate Resilience

Direct

GHG Emissions

Direct

G&EI

Direct

Smart

None

NCV



ACTION 25

Improve performance through digital and governance initiatives



ACTION 26

Improve waste segregation across the city

ACTION 28

Implement the Western Regional Integrated Solid Waste Disposal Facility



Solid Waste – Recycling rates in each district is greater than 35%.

Solid Waste – Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.

Solid Waste – Proportion of total waste sent to landfill is less than 65%.



12 – Responsible Consumption and Production

There are currently only two waste transfer stations across Bursa resulting in waste trucks having to take long-distance trips after collecting the waste and moving it to treatment and disposal facilities. This results in increasing costs associated with the transport of waste and GHG emissions from the combustion of fuel by trucks.

COMPONENTS

1 BUILD THE PLANNED AND MISSING WASTE TRANSFER STATIONS TO FACILITATE THE IMPROVED ORGANISATION AND MOVEMENT OF SOLID WASTE ACROSS THE PROVINCE

The main component of this action is to build the planned and missing waste transfer stations to facilitate the improved organisation and movement of solid waste across the Province. As shown in Figure B16, BMM's Integrated Solid Waste Management Plan (2022) proposes an additional three waste transfer stations in Kestel, Gemlik and Orhaneli Districts. However, following the identification of the area designated for the new Western Regional Integrated Solid Waste Disposal Facility (as part of Action 28), a comprehensive plan should be developed to determine which integrated facility will receive the waste from each of the 17 Districts in Bursa. Subsequently, the specific Districts requiring waste transfer stations, along with the appropriate locations for these facilities, should also be clearly identified.

The new waste transfer stations should include:

- **Entrance and security building** - to keep the entrance/exit of the facility under control, to control vehicles and incoming waste, to monitor the facility security cameras, to provide counselling and application services, security building and entrance/exit gate with automatic barriers.
- **Administrative building** - A building consisting of offices, cafeteria, WC/bathroom for administrative and technical staff to carry out their work.
- **Weighbridge station** - to weigh incoming and outgoing vehicles in order to provide reliable data on waste quantities.
- **Transfer building** - to transfer municipal solid waste from small-capacity vehicles to self-compacting semitrailers.
- **Leachate tank** - to collect leachate from municipal solid waste during the transfer of waste to semitrailers in the transfer building.

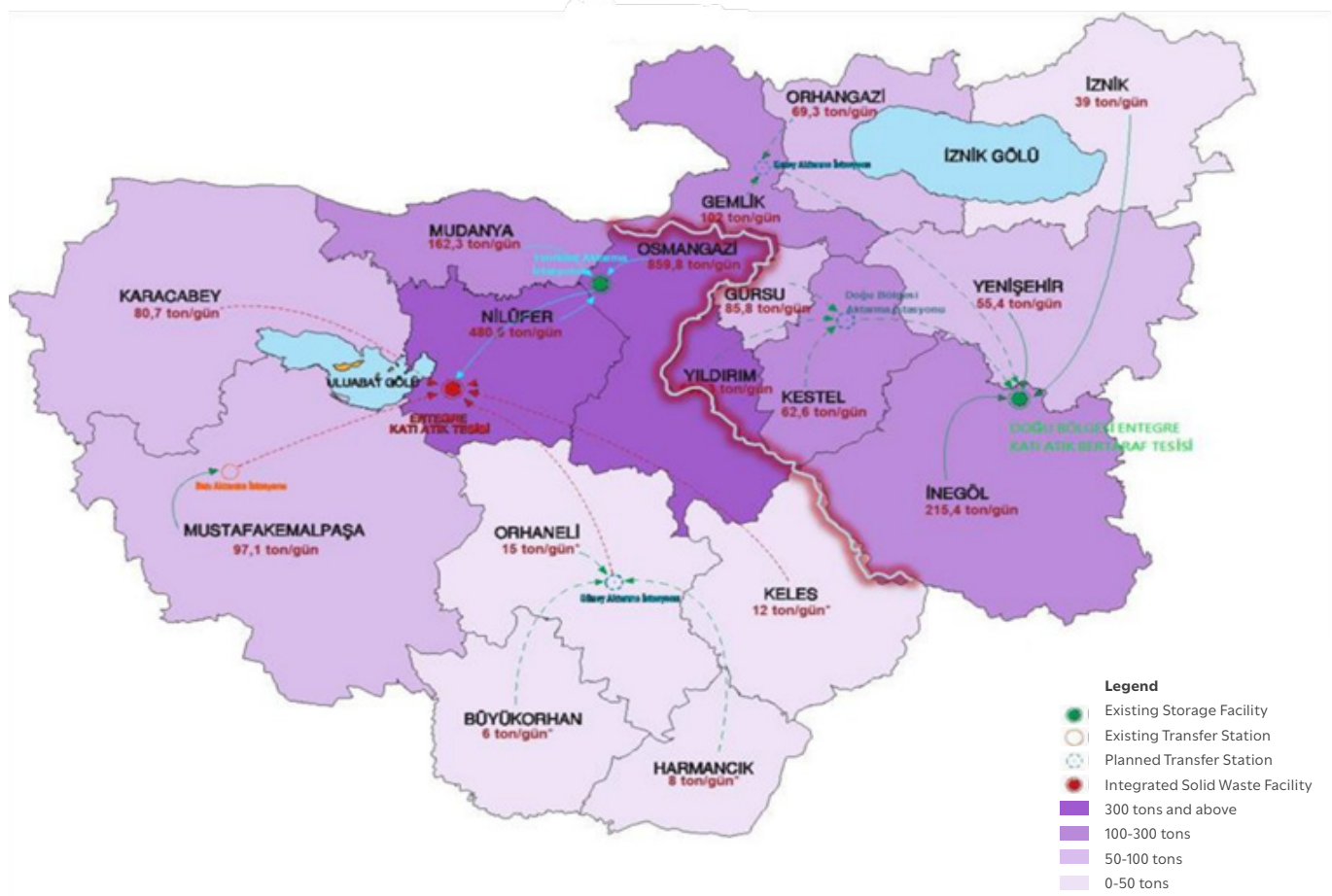


Figure B16: Locations of existing and planned integrated waste management facilities and transfer stations

Source: BMM, Integrated Solid Waste Management Plan, (2022).

- **Emission and odour removal unit** - for the removal of dust and odours generated during waste transport in the transfer building.
- **Repair and maintenance workshop** -for repair and maintenance of vehicles operating at the transfer station.
- **Wheel disinfection unit** - at the exit of the transshipment facility, in order not to transport waste contaminated on the wheels of the vehicles to the city streets and not to pollute the environment.

The sites should also **include any necessary auxiliary infrastructure, for example, energy generation through solar panels, connection to municipal sewerage network or leachate treatment plant**. Any storage and staff buildings should also be fitted with energy and water efficiency measures and devices, such as LED lighting and rainwater harvesting, to ensure efficient resource use. Such measures will help to reduce the transfer stations' GHG emissions and environmental impacts.

This Action focuses on implementing the new waste transfer stations. However, following the implementation of the new transfer stations, existing

transfer stations across the province should be upgraded and any lessons learnt, and best practices developed, applied to provide the same level of service and to ensure enhanced efficiency of the solid waste management and waste transfer across Bursa. This will require further feasibility and assessment of costs needed to upgrade these sites.

TIMELINES

0-3 MONTHS

Develop a stakeholder engagement plan to identify key stakeholders and engagement activities with the aim of keeping stakeholders and the general public informed through the development of the action.

3-6 MONTHS

Undertake a detailed site selection study to identify where the new waste transfer stations should be located to maximise their potential for waste collection across the various Districts across Bursa.

6–10 MONTHS

Undertaking detailed design and any necessary due diligence and feasibility studies, this should also include obtaining any necessary planning and construction licences.

10–18 MONTHS

Procurement of construction services and necessary auxiliary infrastructure and services.

18–24 MONTHS

Implement the new waste transfer stations in a phased manner implementing the planned waste transfer stations and necessary auxiliary infrastructure.

24+ MONTHS

Monitor and evaluate progress and upgrade of existing transfer stations, undertake a review of lessons learnt and best practices implemented as part of the new transfer stations and begin planning for the upgrade of existing waste transfer stations in line with these.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Stakeholder engagement will be a key element** of the development of new transfer stations given the challenges arising from stakeholders in identifying stations for the Western Regional Integrated Solid Waste Disposal Facility in the past.
- **Site selection** will also be key to ensure appropriate locations for the new transfer stations.



KEY STAKEHOLDERS

- **BMM Department of Environmental Protection and Control** – Implementation Agency – all components and steps.
- **Tarım Peyzaj A.Ş. (operator for waste transfer stations)** - Implementation Agency – all components and steps.
- **District Municipalities** – Collaborate and involve – all components and steps.
- **BEBKA** – Consult – all components and steps.
- **Universities and institutions providing consultancy services** - Collaborate and involve – in particular steps 2 and 3.
- **General public** – Inform and Consult – all components and steps 1, 2, 3, and 5.



POTENTIAL FUNDING AND FINANCING SOURCES

Will depend on the delivery model chosen but can include:

- **Own Source** – BMM budget assigned to solid waste management, or developer/operator's equity.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Potential cost savings as a result of improved waste transportation practices across the Province.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Residents across the city will have improved access to solid waste management services through this action. The action has the potential to generate 30 jobs for operation of the new facilities, and efforts to channel these employment opportunities to women and disadvantaged groups should be deployed, including through targeted development programmes, employment quotas, and inclusive procurement practices.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Improving capacity and efficiency in transfer stations builds redundancy in the solid waste management system. During site selection and development of new infrastructure, resilience considerations must be taken into account to ensure minimal service disruptions due to hazards or shocks.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – While not quantifiable at this stage, this action will likely result in GHG emissions reductions through energy efficiency resulting from the upgradation of existing transfer stations and more efficient operations of associated fleets.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action presents opportunities to implement IoT devices to optimise operations. Installation of sensors to monitor fill rates for containers can ensure trips between transfer stations and treatment/disposal facilities are undertaken in an efficient manner. Moreover, data collected can also feed into the Digital Solid Waste Management Platform and inform future planning and investment activities while providing a clearer picture of waste management practices in Bursa.



IMPACT ON NATURAL CAPITAL VALUE

No impacts – the action does not affect natural assets, ecosystems or the services they provide. In developing the new transfer stations, the selection of the stations should avoid areas of high natural capital value (e.g. woodlands, wetlands) or protected/irreplaceable habitats.



Orhaneli Transfer Station

Implement the Western Regional Integrated Solid Waste Disposal Facility

Implement the planned Western Regional Integrated Solid Waste Disposal Facility and develop a transition plan for the existing Yenikent Solid Waste Landfill.

RELEVANT THEMES

#solidwaste

#industries

#mitigation

#circulareconomy

#G&EI

#energy



Capital Investment (Project)



BMM Department of Environmental Protection and Control



Western district (precise location to be determined, based on feasibility study)



Planned



Medium (2-5 years)



€ 600,000 Development/advisory costs
 € 200,600,000 Capital costs
 € 54,350,000 Operational costs (over 5 years)



Direct Climate Resilience
Direct GHG Emissions - 35,000 tCO₂e/year
Direct G&EI
Direct Smart
Indirect NCV


ACTION 25 Improve performance through digital and governance initiatives

ACTION 26 Improve waste segregation across the city

ACTION 27 Enhance capacity and efficiency of waste transfer station network

Solid Waste – Recycling rates in each district is greater than 35%.

Solid Waste – Proportion of total waste treated in sorting, processing and treatment plants is greater than 40%.

Solid Waste – Proportion of total waste sent to landfill is less than 65%.


7 – Affordable and Clean Energy

12 – Responsible Consumption and Production

Bursa currently hosts one Integrated Solid Waste Disposal Facility found in the East of the Province in İnegöl District and one landfill, Yenikent Solid Waste Landfill, in the centre of the province in Osmangazi District. In addition, the province has several other waste facilities dealing with medical waste sterilisation, excavation, construction and demolition waste and soil recovery. However, given the quantity of waste generated, projected population growth over the next few decades and shrinking lifespan of current waste disposal sites, a new Integrated Solid Waste Disposal Facility is required.

Such a facility has been in development over the past decade and is intended to be found in the west of the Province. The ongoing study incorporates public and stakeholder perspectives and concerns regarding the proposed site location, its potential environmental impacts, as well as matters related to site acquisition and expropriation.

Therefore, **this action seeks to elaborate and build upon the work already undertaken to develop the new Western Regional Integrated Solid Waste Disposal Facility** by identifying the necessary infrastructure, equipment and technology needed to facilitate improved waste management practices and proposing steps to resolve some of the previous challenges faced. Moreover, the action also **proposes the development of a transition plan for the Yenikent Solid Waste Landfill** ensuring it continues to operate while the new facility is built out and is safely closed down and remediated upon reaching its maximum lifespan.

COMPONENTS

1 DEVELOPMENT OF NEW WESTERN INTEGRATED SOLID WASTE DISPOSAL FACILITY

- **Waste receiving** – including collection and transfer vehicle parking area, weighing station, vehicle washing facilities, etc.
- **Waste sorting and processing** – include a combined Materials Recovery Facility (MRF) and Mechanical-Biological Treatment Facility (MBT) to sort and process mixed municipal solid waste into its various waste streams, including dry recyclables and materials for reuse, organic waste (directed to the composting facility or Biomethanisation Plant) and any remaining waste to be directed to landfill.

This could be a manual facility needing people to manually sort the materials or an automated facility which uses artificial intelligence and machine learning to sort recyclable materials.

- **Composting Facility** - The site should also include a Composting Facility where organic wastes from the waste separation unit of the integrated facility and wastes from the market, which are rich in organic content, will be processed. This facility should initially ensure that the compost obtained should be used in the parks and gardens of BMM, and in the future, it should be developed in such a way that it can be packaged and offered for sale as a commercial product.
- **Landfill gas to energy production plant** - It is a plant where landfill gas formed by mixed municipal wastes coming to landfills for disposal is collected by controlled gas collection systems and electricity is generated. In this facility, the work steps of landfill gas extraction, processing, gas engine combustion and energy generation consist of booster, gas processing and flare station and electricity generation facilities. Landfill gas will be systematically collected and converted into energy by combustion in gas engines by making it usable as fuel with appropriate conditioning systems and preventing the release of landfill gas into the atmosphere.
- **Biomethanisation plant** - includes a Biomethanisation Plant to process organic waste using anaerobic digestion to produce biogas. In these plants, organic wastes are physically treated and then fermented in an anaerobic environment to produce biogas, which is burned in gas engines and converted into electrical energy. Biogas can be used to generate electricity or as fuel for waste transfer vehicles. The exact capacity of the plant should be determined as part of the design and feasibility of the component and will depend on the availability of waste and biomass.
- **Landfill facility**– include an EU-compliant landfill composed of multiple cells to accommodate of waste over at least a 15-year lifespan. The size of the landfill will need to be determined as part of the project preparation activities. This should be an engineered landfill with a lining and leachate and landfill gas collection system to minimise environmental impact.

Necessary structures, such as entrance and security, weighbridge building, administrative building, laboratory, workshop building, wheel disinfection unit,

etc. should be installed in addition to the above units. The site should also **include any necessary auxiliary infrastructure, for example, energy generation through solar panels, connection to municipal sewerage network or package leachate treatment plant**. Any storage and staff buildings should also be fitted with energy and water efficiency measures and devices, such as LED lighting and rainwater harvesting, to ensure efficient resource use. Such measures will help to reduce the facility's GHG emissions and environmental impacts.

2 TRANSITION PLAN FOR THE EXISTING YENIKENT SOLID WASTE LANDFILL

- **Lifetime extension – Identifying additional opportunities to extend the lifetime of Yenikent Solid Waste Landfill.** This is aimed at enabling the disposal of solid waste while the planned Western Regional Integrated Solid Waste Disposal Facility is developed. The study should identify methods of lifetime expansion, for example, compaction, daily covering alternatives, banning certain waste streams, etc.
- **Closing and remediation** – The Transition Plan should also **assess any necessary activities associated with safely closing and remediating the landfill** ready for potential future uses while facilitating continued gas collection for energy generation.

There are a number of delivery models the new facility could be delivered under; for example:

- **Traditional public sector delivery** – where BMM undertake the full funding, ownership and operation of the facility, this means they have full control ensuring alignment with policy and strategic priorities; however, this will be a significant financial funding due to high costs.
- **Build-Operate-Transfer** – where BMM would contract a private company to build and operate the facility for a set timeframe before it is transferred back to Municipal ownership, this can often include a concessional model of delivery. This can encourage private investment and expertise while retaining public ownership of the facility; however, it requires robust governance and regulation to protect the public interest. Some municipalities tender for the construction and operation of such facilities by renting out the permitted areas, while others form an association with relevant institutions and organisations and enter into 25-30 year concession agreements with the private sector. In addition, some municipalities also transfer these

services to the private sector through contracts including the establishment of 29-year easement rights and the right to use allocated/permited areas.

- **Joint venture or Public-Private Partnership (PPP)** – where BMM collaborates with a private sector entity to deliver and operate the site. Both parties would share responsibility, risk and reward. This could also be beneficial to ensuring public oversight and maintaining private sector efficiency. However, these can have complicated governance structures and result in potential conflicts of interest.

TIMELINES

COMPONENT 1:

0–3 MONTHS

Develop a stakeholder engagement plan to identify key stakeholders and engagement activities with the aim of keeping stakeholders and the general public informed through the development of the action.

3–6 MONTHS

Undertake a detailed site selection study to identify where the new Western Regional Integrated Solid Waste Disposal Facility should be located, taking into account past challenges with securing a site.

6–24 MONTHS

Undertaking detailed design, environmental and social impact assessments and other necessary due diligence and feasibility studies, and identifying the most appropriate delivery model, this should also include obtaining any necessary planning and construction licences.

24–30 MONTHS

Procurement of construction and waste management services (if necessary) and necessary auxiliary infrastructure and services.

30–48 MONTHS

Implement the new Western Regional Integrated Solid Waste Disposal Facility, this could potentially be implemented in a phased manner with expansions to the facility occurring beyond the 5-year GCAP planning period.

COMPONENT 2:

0–9 MONTHS

Develop a Transition Plan for the Yenikent Solid Waste Landfill.

9+ MONTHS

Begin the implementation of the Transition Plan, starting with the additional measures to extend the landfill's lifetime followed by eventual closedown and rehabilitation activities in the coming 10 years.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Stakeholder engagement will be a key element** of the development of the new facility given the challenges that have arisen when trying to implement this facility over the past decade.
- **Site selection** will also be key to ensure appropriate locations for the new facility, it may mean that the previously chosen site is deemed inappropriate given past challenges and therefore a new site needs to be selected.
- **Procurement for construction and delivery of the new facility** may be a challenge given the past difficulties with finding a delivery partner for the facility, therefore, additional support and effort needs to be taken in securing the most appropriate delivery mechanism.



KEY STAKEHOLDERS

- **BMM Department of Environmental Protection and Control** – Implementation Agency – all components and steps.
- **District Municipalities** – Collaborate and involve – all components and steps.
- **BEBKA** – Consult – component 1 and all steps.
- **Universities** – Collaborate and Involve – in particular component 1, steps 2 and 3, and component 2, steps 1 and 2.
- **Relevant state institutions** – Consult – in particular component 1.
- **General public** – Inform and Consult – in particular component 1, steps 1, 2, 3, and 5.



POTENTIAL FUNDING AND FINANCING SOURCES

Will depend on the delivery model chosen

- **Own Source** – BMM budget assigned to solid waste management.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Loans** – Ilbank, IFIs, and commercial banks.
- **Public-Private Partnership** as stipulated by Law 3996.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Multiple streams of revenue could be achieved through the implementation of this action, for example, by charging waste treatment and disposal fees or through the sale of biogas and energy produced at the new facility.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action will result in improved access to waste management services for residents across the city. The action has the potential to generate 70 jobs for operation of the new facility. Where suitable, measures such as targeted development programmes, employment quotas, and inclusive procurement practices should be considered to ensure women, underserved groups and youth can take advantage of these employment opportunities.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action will increase the waste management capacity of the city and provide spare capacity in case of any disruption to a similar facility serving the eastern part of the city. Site selection and infrastructure design should consider key climate and disaster risks such as flooding, landslides, and earthquakes.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – The key driver of GHG emissions reduction as a result of this action is the potentially lower volumes of waste ending up in landfill and causing methane emissions. Further reduction can be achieved by optimising site operations and transfer of waste.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action presents opportunities to implement IoT devices and smart sensors to optimise waste management and cameras and artificial

intelligence/machine learning as part of the MRF to recycled material into its constituent waste streams. The biomethanisation plant is a 'smart' technology measure to generate biogas as a renewable fuel source used for energy generation or as fuel for transport.



IMPACT ON NATURAL CAPITAL VALUE

Indirect impacts – Solar energy and biogas energy generation included in this action will contribute to the renewable energy ecosystem service. In developing the new facility, the selection of the site should avoid areas of high natural capital value (e.g. woodlands, wetlands) or protected/irreplaceable habitats. Future rehabilitation of the Yenikent Solid Waste Landfill will result in positive impact for local ecosystems and result in increased NCV.

Climate and Environment

29

Develop a digital dashboard for air, noise, water and soil quality monitoring

30

Develop a 'River Depollution Roadmap' for the Nilüfer Stream

31

Develop a Heat Action Plan

32

Implement nature-based solutions along urban rivers





Suuçtu Nature Park and Waterfall, Mustafakemalpaşa



Develop a digital dashboard for air, noise, water and soil quality monitoring

Develop a digital dashboard to enhance monitoring, data sharing, and reporting of air, water, noise and soil quality pollution.

RELEVANT THEMES

#transport

#industries

#digital

#climate&environment

#energy



Data / Monitoring System
Capital Investment (Project)



BMM Department of Environmental Protection and Control
BUSKI
DSI



Bursa-wide



New and Ongoing



Short (<2 years)



€ 50,000 Development/advisory costs
€ 355,000 Capital costs
€ 175,000 Operational costs (over 5 years)

Indirect

Climate Resilience

None

GHG Emissions



Direct

G&EI

Direct

Smart

Indirect

NCV



ACTION 1

Develop a 'City Guide'

ACTION 30

Develop a 'River Depollution Roadmap' for the Nilüfer Stream



Climate & Environment – 100% of vehicular and industrial air pollution hotspots are covered by air quality monitoring equipment covering all particulate and gaseous pollutants.

Climate & Environment – 100% of water from municipal WWTPs and industrial areas are covered by water quality monitoring equipment.

3 – Good Health and Well-being

6 – Clean Water and Sanitation

9 – Industry, Innovation and Infrastructure

11 – Sustainable Cities and Communities

14 – Life Below Water

15 – Life on Land

The environmental challenges associated with air, noise, water and soil quality are closely interconnected. In Bursa, air pollution is primarily caused by traffic, industrial activities and domestic heating. Water pollution is mainly caused by the discharge of partially treated domestic and industrial wastewater and run-off from agriculture fields; this can be further exacerbated by acid rain due to air pollution. These increased levels of air and water pollution contribute to the deterioration of soil quality. Data collection and real-time monitoring are critical for a comprehensive understanding of how to address these environmental challenges.

However, the current monitoring system implemented in Bursa do not collect sufficient environmental data on a Provincial level. Bursa's air quality monitoring is limited to the urban districts and excludes the rest of the Province, therefore, not providing an accurate assessment of air quality. There is a lack of comprehensive data and information relating to surface and groundwater quality across Bursa. The data which is collected is spread across various water sector-related government organisations and institutions and often lacks cooperation and collaboration. Similarly, there is no monitoring of groundwater extraction and use by industries and farmers.

Therefore, this action aims to enhance environmental data collection and sharing among various stakeholders by improving the quality and coverage of real-time monitoring, establishing a reporting mechanism to track the quality of environmental indicators and developing a digital dashboard to enhance data sharing and communication.

COMPONENTS

1 ENHANCING ENVIRONMENTAL DATA MONITORING

- **Air quality** – The existing air quality monitoring stations should be upgraded to real-time monitoring to capture all the critical air pollutants. Moreover, the coverage of air quality monitoring should be expanded across the entire Province to capture a clear understanding of air pollutants and sources. The action proposes to fund 10 new air quality monitoring stations (estimated to cost around €90,000). These should be located near known air pollution hotspots, such as OIZs and along key roads, to help develop a better understanding of air

quality near pollution sources. The real-time data from the air quality monitoring stations should be incorporated into the dashboard.

- **Surface and seawater quality** – Monitoring of water quality should be improved by increasing the spatial extent of data collection, especially at point source pollution outlets including stormwater and wastewater treatment plant outfalls along streams and the coast. This should include a study to identify strategic locations to collect data near these point sources of pollution. Data should be collected at least three times a year; prior to, during and after the rainy season (typically spanning December to January). This data should be incorporated into the digital dashboard. This should look to be regular of even real time data collection (including on temperature, oxygen, nitrate, turbidity etc.) to build an accurate picture of current water quality.
- **Groundwater quality and extraction** – A study should be conducted to identify strategic locations for groundwater quality monitoring based on land use activities, quantity and rate of extraction. Monitoring should focus on industries and agriculture activities. In addition, the powers of DSI should be strengthened to mandate stricter groundwater extraction monitoring, in particular by industries. The DSI's existing register should be further elaborated to establish a comprehensive inventory of groundwater database across the Province and this data should be shared with BMM on a regular basis and incorporated into the digital dashboard.
- **Soil quality** – it is understood that soil quality has been analysed in 14 districts across Bursa by the Ministry of Agriculture and Forestry (Agricultural Reform) and Karacabey District is of particular importance for soil quality monitoring. It is therefore advised that such activities continue and are regularly updated with new studies, at least once a year, to maintain records and a high level of understanding of soil quality across the province.
- **Noise** – the number of monitoring stations should be expanded; these could be incorporated into the air quality monitoring stations. Real-time data should be collected and incorporated into the digital dashboard.

Based on the enhanced data collection, annual monitoring reports for air, water, noise and soil pollution should be prepared by each District within Bursa. These reports should capture the pollution levels, and sources and explore possible mitigation strategies. Costs of the data gathering and report

creation should be covered by the OPEX costs. Moreover, despite a lack of laws mandating reporting of industrial environmental impacts, BMM should establish strong relationships and engage with industries and OIZs across the Province to obtain any environmental data gathered by industries to supplement their reporting.

② DEVELOPING AN ENVIRONMENTAL DATA DIGITAL DASHBOARD

A digital dashboard should be prepared to capture the various environmental data, including real-time information on air and noise; and periodic reporting of water and soil quality. The data should be shared with all relevant stakeholders, institutions and organisations. The data should be able to be filtered and overlaid based on sectors, locations and Districts, river basins, land uses, etc., The digital dashboard should be designed with the user and accessibility in mind to ensure it is easy to use and navigate. Set up and development of the dashboard, including server and network infrastructure, is estimated to cost around €265,000.

TIMELINES

0–6 MONTHS

Conduct the relevant studies to identify strategic locations for environmental data monitoring, including identifying the locations for air pollution hotspots and the installation of additional air quality monitoring stations, point source water pollution sources and soil quality data collection.

6–12 MONTHS

Procurement and installation of the monitoring equipment based on the study conducted. Also, update/upgrade the existing equipment.

6–12 MONTHS

Develop the digital dashboard for improved data sharing on air, water and soil quality across relevant institutions and organisations.

6–12 MONTHS

Coordinate and collaborate with all the relevant stakeholders to collate and update the dashboard information dispersed among various institutions and organisations.

12–24 MONTHS

Establish the protocols and begin annual reporting processes for all the Districts within Bursa regarding

air, water, soil quality and noise, and further incorporate the report outcomes on the digital dashboard. This should also include establishing relationships with industries and OIZs to gather any of their environmental reporting to supplement any data gaps.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Need for comprehensive soil and water quality monitoring and real-time air and noise quality monitoring** to capture an up-to-date and holistic understanding of the environmental challenges.
- **Need for collaboration and coordination** for a comprehensive understanding of cross-cutting challenges across air, noise, water and soil pollution.
- **Need for a point source of data collection, monitoring, dissemination and coordination across various stakeholders** related to environmental challenges. BMM Department of Environmental Protection and Control need to lead this action.
- **Strict enforcement of pollution and emissions monitoring and reporting for the industries** for effective implementation of actions to address the environmental challenges.



KEY STAKEHOLDERS

- **BMM Department of Environmental Protection and Control** – Implementation Agency – All Components and Steps.
- **State of Hydraulic Works (DSI)** – Implementation Agency – All Components and Steps 4 and 5.
- **BUSKI** – Implementation Agency – All Components and Steps 4 and 5.
- **BMM Department of Information and Technology (GIS Branch Directorate)** – Involve and Collaborate – Component 2 and Step 3.
- **District Municipalities** – Consult, Involve, Collaborate – Component 5 and Step 5.
- **Industries** – Consult, Involve, Collaborate – Component 1 and Steps 4 and 5.
- **Bursa Provincial Directorate of Agriculture and Forestry** – Consult, Involve, Collaborate – Component 1 and Steps 1, 4, and 5.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budgets associated with environmental protection and monitoring.

- **Grant** – National government, IFIs (for project preparation) and development organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



Yes

Monitoring and reporting of air, water and soil pollution can identify the source and lead to revenue from fines/penalties.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – Through better and more widespread monitoring of environmental indicators, the impact of environmental pollution on vulnerable groups or underserved communities can be better understood. This could help in prioritising mitigation activities targeting vulnerable groups.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – Real-time monitoring and data collection of environmental challenges will aid in the assessment of climate risks and hazards.



IMPACT ON GHG EMISSION REDUCTION

No impacts



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Direct impacts – This action includes deployment of state-of-the-art, real-time monitoring equipment to support effective communication and collaboration.



IMPACT ON NATURAL CAPITAL VALUE

Indirect impacts – Real-time monitoring and data collection of environmental indicators will aid in monitoring ecosystems and the services they provide. Moreover, better environmental data can be used to inform/facilitate additional actions that reduce pressure on nature and/or enhance ecosystem services.



Malkara Beach, Karacabey

Develop a 'River Depollution Roadmap' for the Nilüfer Stream

Develop a roadmap to address water pollution and reduce ecosystem impact of urban development on Nilüfer Stream.

RELEVANT THEMES

#landuse

#industries

#water

#climate&environment

#resilience



Strategy / Plan / Study

BUSKI



BMM Department for Environmental Protection and Control (for coordination of action delivery)

DSI and BTSO (for eventual 'River Depollution Roadmap' implementation)



Bursa-wide



New



Short (<2 years)



€ 300,000 Development/advisory costs
 € 0 Capital costs
 € 0 Operational costs (over 5 years)

**Indirect** Climate Resilience**Indirect** GHG Emissions**Indirect** G&EI**Indirect** Smart**Direct** NCV - €8,077,548 annual NCV impact**ACTION 29**

Develop a digital dashboard for air, noise, water and soil quality monitoring

**Water** – 100% of the municipal population is served by a wastewater treatment plant.**Climate & Environment** – Greater than 25% of length of channelised streams are replaced with nature-based solutions for mitigating flood risk.**Climate & Environment** – Tree canopy cover in each district is greater than 20%.**3** – Good Health and Well-being**6** – Clean Water and Sanitation**9** – Industry, Innovation and Infrastructure**11** – Sustainable Cities and Communities**14** – Life Below Water

The Nilüfer stream, being one of the main streams running through Bursa, is exposed to a variety of point¹⁰¹ and diffuse¹⁰² pollution sources and has therefore been observed to be one of the most polluted surface water resources in Bursa. The Nilüfer stream joins the Susurluk stream and eventually empties into the Sea of Marmara at the Karacabey strait. Anecdotal evidence suggests a large portion of the marine pollution is from land-based activities, such as agricultural runoff or discharge of partially treated effluent, therefore enhancing the quality of surface water running through the Nilüfer Stream is important to reducing pollution in the Sea of Marmara¹⁰³.

This action aims to develop a roadmap to rehabilitate the condition of the Nilüfer Streams, first by mapping the water quality and sources of pollution, followed by the development of mitigation measures and then a monitoring and reporting system to track the health of surface water quality and the aquatic ecosystem. The action has the potential of developing NbS which would come with co-benefits, especially to the vulnerable communities along the rivers and streams which might be prone to flood and soil erosion risks.

COMPONENTS

1 CONDUCTING A STUDY TO MAP WATER QUALITY AND SOURCES OF POLLUTION

- **Enhance testing of water samples** at multiple locations along the Nilüfer stream and near point and diffuse source pollution sources. It is understood that BUSKI currently undertake such studies, but these should be enhanced to be undertaken daily for a longer time frame, or using real time sensors on temperature, oxygen, nitrate, turbidity, etc., to build a comprehensive picture of water quality in the Stream and monitor benefits of any interventions over time.
- **Identifying key stakeholders** who may contribute to the management of the stream or pollution sources, including industry and farmland owners, representatives from BUSKI and other local government organisations.
- **Detailed mapping of key land uses and point source pollutants along the Stream**, including the types of industry and potential pollutants released into the Stream, quantities of released partially treated wastewater, types and quantities of fertilizer and pesticide use on agricultural land, drainage networks and their outfalls, solid waste management infrastructure, etc.

2 DEVELOPING THE 'RIVER DEPOLLUTION ROADMAP' FOR THE NILÜFER STREAM

Using the study undertaken as part of Component 1, the 'River Depollution Roadmap' should be developed to identify opportunities and bankable projects, including:

- **Green and blue Infrastructure** – for example, constructing new floating wetlands, implementing swales and raingardens, and planting trees to capture and filter water.
- **Gray infrastructure** – for example, work with industries to reduce their impact on surface water quality by reducing pollution loads and improving wastewater treatment mechanisms, redeveloping drainage networks as separate systems to sewerage systems, or implement barriers or floating barges to collect litter and rubbish from the rivers surface.
- **Policy and regulation** – for example, strengthening monitoring and potential for issuing fines on polluters, in particular industries outside OIZ who do not comply with effluent discharge standards.

TIMELINES

0–6 MONTHS

Begin stakeholder identification and land-use and pollution source mapping, to develop an understanding of current conditions affecting the Nilüfer Stream.

0–6 MONTHS

Undertake the collection and testing of water samples, at various locations along the stream across a few weeks' time frame to gain a deep understanding of water quality in the Stream.

6–12 MONTHS

Develop the 'River Depollution Roadmap' taking into account the findings from steps 1 and 2 to develop a list of bankable projects to be implemented along the Nilüfer Stream.

12+ MONTHS

Begin implementation of interventions identified in the roadmap, including undertaking any necessary feasibility and due diligence and working with stakeholders to facilitate implementation.

POST IMPLEMENTATION

Repeat the collection and testing of water samples at the same locations along the stream no earlier than a year after the actions from the roadmap have begun to be implemented to understand if these are having

a positive impact on the Stream and if any course correction needs to be implemented.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Need for comprehensive data collection, digitization and periodic updating (annually) of water quality** within the Nilüfer Stream.
- **Need for the involvement of innovative solution providers, subject matter experts and financing agencies** for identifying potential mitigation measures and nature-based solutions.
- **Strict enforcement of pollution monitoring and reporting for the industries** for effective implementation of actions to address the environmental challenges.



KEY STAKEHOLDERS

- **BUSKI** – Implementation Agency – All Components and Steps.
- **BMM Department of Environmental Protection and Control** – Implementation Agency (for coordination) – All components and steps.
- **State of Hydraulic Works (DSI)** – Implementation Agency – Coordination of All Components and Steps.
- **Provincial Directorate of the Ministry of Agriculture and Forestry** – Consult and collaborate – All Components and Steps 1 and 2.
- **OIZs** – Consult and collaborate – All Components and Steps 1 and 2.
- **BTSO** – Consult and collaborate - All Components and Steps 1 and 2.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budgets associated with environmental protection and monitoring.
- **Grant** – National government, IFIs (for project preparation) and development organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

However, monitoring and reporting of water pollution can identify the source and lead to revenue from fines/penalties.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The impacts of river and surface water pollution on underserved groups should be taken into account when developing interventions in the Roadmap. Gender mainstreaming approaches should be taken into consideration when developing the Roadmap.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The Roadmap can prioritise dual-benefit interventions i.e. those that reduce water pollution as well as improve resilience to floods and droughts.



IMPACT ON GHG EMISSION REDUCTION

Indirect impacts – Several nature-based interventions targeting water pollution may also enable carbon sequestration, thus supporting GHG emissions reductions in the city.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The action can consider piloting novel approaches to understand current conditions and the potential impact from interventions, such as drone mapping of pollution sources and using GIS for analysis.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – Implementation of interventions in the Roadmap will enhance natural capital value from water resources, through the improvement of water quality and aquatic systems. Other natural capital benefits from these interventions may include flood alleviation and local climate regulation.

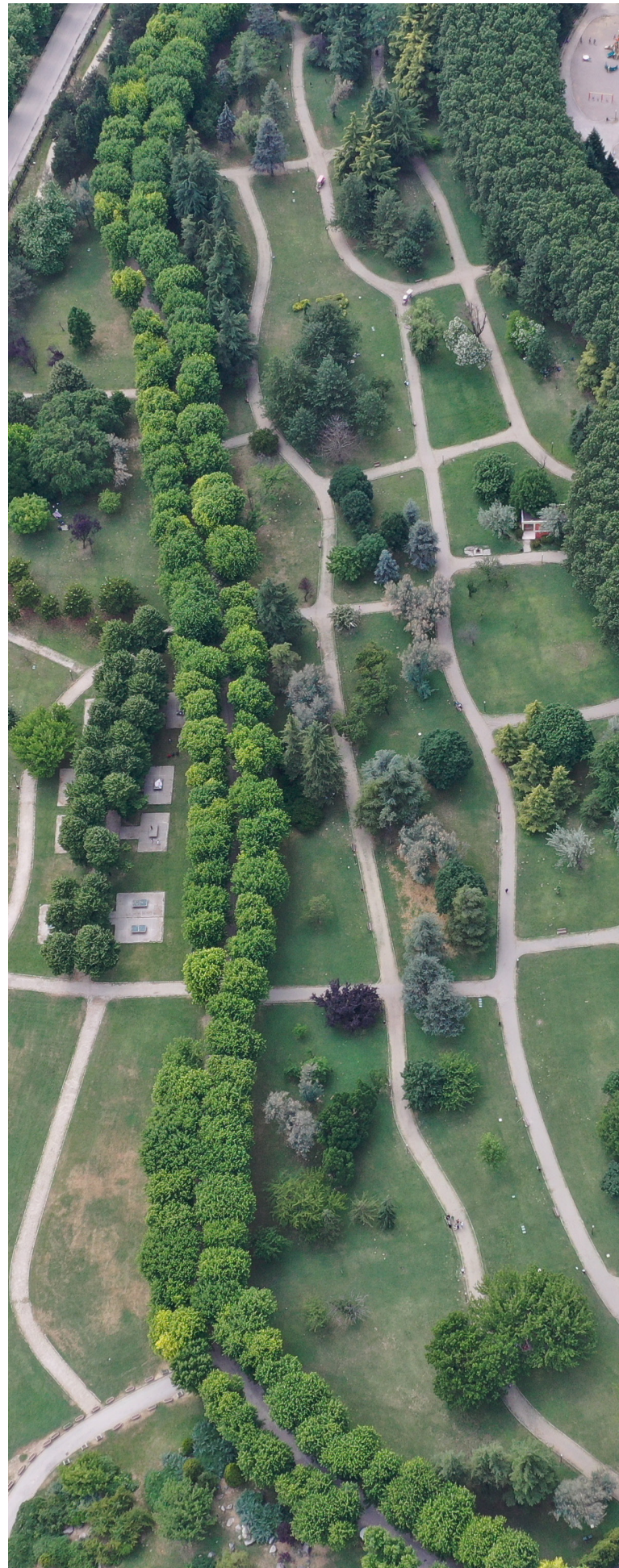
Estimated annual NCV impact: €8,077,548

Ecosystem service impacts estimated using bottom-up approach. This action is likely to have positive impacts on global climate regulation(€4,018,140), recreation(€5,557,343), flood regulation (€921,153), water quality (€25,363), and crop provisioning (n/a).

101. Point source pollutants mainly arise from the discharge of partially treated household and industrial wastewater.

102. Diffuse source pollutants mainly come from agriculture-related activities in the form of return flow carrying excessive pesticides and fertilizers.

103. <https://www.tarimorman.gov.tr/SYGM/Belgeler/havza%20koruma%20eylem%20planlar%C4%B1/Susurluk-Havzasi.pdf>



Erdem Saker Botanik Park, Osmangazi



Develop a Heat Action Plan

Develop an action plan to build urban heat resilience in Bursa.

RELEVANT THEMES

#landuse

#NBS

#G&EI

#climate&environment

#resilience



Strategy / Plan / Study

BMM Department of Environmental Protection and Control
(for coordination of action delivery)BMM Department of Parks and Gardens and Provincial
Directorate of MoEUCC (for implementation of action)

Bursa-wide



New



Short (<2 years)



€ 300,000 Development/advisory costs
€ 0 Capital costs
€ 0 Operational costs (over 5 years)



Direct Climate Resilience
None GHG Emissions
Direct G&EI
Indirect Smart
Indirect NCV



ACTION 8

Implement sustainability and resilience
interventions in BMM-owned buildings**Land Use** – Per capita green space across each urban
district is greater than 15 m².**Climate & Environment** – Tree canopy cover in each district
is greater than 20%.

3 – Good Health and Well-being
5 – Gender Equality
11 – Sustainable Cities and Communities
13 – Climate Action

Under the worst-case scenarios, annual average temperatures in Bursa are set to increase by up to 7°C by 2100 resulting in an increase in extremely hot days from 10-15 between 1961 to 1990 to around 30-40 by 2100. Conversely, precipitation levels are expected to decrease resulting in more drought events. Moreover, with the changes in land use, due to urban development and reduction in green cover, especially in urban areas, the impact of heat stress on Bursa's infrastructure, people and economy is expected to become severe over the coming century. Increased heat stress will most likely also increase the likelihood and impact of wildfires, for example as seen across the Northwest region of Türkiye in the summer of 2025.

The action aims to reduce the adverse impacts of extreme heat on the health and well-being, livelihoods, infrastructure and environment of Bursa.

COMPONENTS

1 UNDERTAKING AN ASSESSMENT OF BASELINE AND FUTURE HEAT RISK

The assessment should be considered under the following main aspects:

- **Assessment of context and city's capacity to assess heat risk**, which includes a review of institutional and policy framework and key stakeholders;
- **Evaluation of the components of heat risk**, for instance, historical data related to extreme heat events, and their frequency and intensity, to understand the hazard, population and infrastructure exposed to heat risk and its impact to assess the vulnerability. This could include undertaking household and stakeholder surveys, measuring heat at various locations or undertaking analysis of remote sensing data to identify heat hotspots; and areas at risk of wildfire;
- **Assessments of Climate Change impacts**, including across the various climate scenarios and emissions pathways to gain a full picture of how heat risks and associated hazards, for example wildfires, will change across Bursa in the future; and
- **Assessment of heat risk itself** to understand the impact on health, productivity and economy.

2 DEVELOPING THE 'HEAT ACTION PLAN'

This involved developing a 'Heat Action Plan' aimed at the following:

- **Communicating heat risks** and impacts to policymakers and stakeholders to garner the political interest to take action and raise awareness amongst the citizens about the hazard.
- **Setting objectives for heat management** aimed to help prioritise resources and solutions to be deployed to maximise the benefits and minimize the impact of the risk. This should be with respect to setting objectives as thresholds as well as targets to implement the actions and monitor their progress.
- **Outlining and prioritising NbS and other heat resilience solutions** should be identified in the context of Bursa and further narrowed down by prioritising solutions in terms of their feasibility and impact to ensure effective use of resources and capacity. The focus should be on NbS, such as increasing tree cover by planting street trees, urban forests, developing sponge city schemes, increasing green spaces or deploying green walls on municipal buildings throughout the city. This should include identifying potential locations, stakeholders, costs and finance options, and timelines for implementation.
- **Monitoring and evaluation** of solutions' impact on heat risk metrics and targets should be undertaken to monitor the progress of solutions. This will help to understand the impact of solutions in building urban heat resilience and maximise the success of solutions and actions by highlighting where additional effort and resources are needed to bolster implementation efforts.

3 IMPLEMENTING A HEATWAVE RESPONSE FRAMEWORK

A framework should be developed for heat response with actions to be taken before, during and post heatwave for effective preparedness and to minimise the impact of the hazard. This could include:

- **Preparing awareness raising and educational material** on activities individuals could take to mitigate heat risk, for example stocking up on bottled water or reducing their time in direct sunlight.
- **Establish an early Warning System** based on temperature thresholds and set up a mechanism for communicating these warnings, for example through SMS, TV and Radio adverse or social media posts.
- **Establish resource stockpiles and relationships with NGOs and local community leaders** to be able to distribute vital resources to vulnerable groups during the heatwave.

TIMELINES

0–12 MONTHS

Conduct a baseline assessment study for heat risk to establish the context, intensity of the hazard in the context and capacity of the city to assess the heat risk.

0–24 MONTHS

Communicate the action towards heat management, with the decision-makers for effective up-take of the action and with the citizens to raise awareness about the heat risk. This should be done throughout the process and post-development and adoption of the Heat Action Plan.

6–12 MONTHS

Establish objectives, targets and KPIs for heat management based on the baseline assessment and existing capacity of the city. Identify existing policy framework entry points for effective integration of heat management within the current strategic objectives and goals of the city.

12–18 MONTHS

Develop the 'Heat Action Plan' in collaboration and consultation with the key stakeholders and citizen inputs with an evidence-based and data-driven approach. This also includes identifying a list of NbS with roles and responsibilities within the stakeholders to implement the solutions. Identify the funding streams for these projects with innovative financing models.

18–24 MONTHS

Adopt the 'Heat Action Plan' and prepare the identified list of NbS and heat resilience solutions for implementation.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- **Need for the city to understand its heat risk context along with its capabilities and limitations to tackle the same.** This is crucial for extreme heat management planning and prioritizing the measures and finances.
- **Need to identify opportunities within the existing policies and regulations to integrate heat considerations.** This will not only mainstream the extreme heat risk but also support effective implementation with minimum efforts and finances.
- **Need to understand key seasonal and climate considerations, especially for the implementation of actions.** For instance, optimum planting season to ensure successful growth and survival rate.



KEY STAKEHOLDERS

- **BMM Department of Environmental Protection and Control** – Implementation Agency – All Components and Steps
- **BMM Department of Disaster Management** – Implementing agency – all components and steps.
- **BMM Department of Information and Technology (GIS Branch Directorate)** – Collaborate and involve – Component 1 and Step 1.
- **BMM Department of Parks and Gardens** – Collaborate – Steps 3, 4 and 5
- **Provincial Directorate of MoEUCC** – Collaborate and involve – all Components and Steps
- **General public** – Inform – all Components and Steps.
- **Universities** – Consult and collaborate – all Components and Steps.



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budgets associated with environmental protection and monitoring.
- **Grant** – National government, IFIs (for project preparation) and development organisations.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

No direct revenue generation or cost saving opportunities as a result of this action.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action addresses a climate risk that disproportionately impacts children, the elderly and low-income populations and offers a direct benefit from the perspective of inclusion. Groups most vulnerable to extreme heat should be involved at all stages of heat action planning, from assessment to implementation, and potential interventions should be assessed for opportunities to enhance benefits for vulnerable groups. Gender mainstreaming approaches should be taken into consideration when developing the Action Plan.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The Heat Action Plan will enable a deeper understanding and identify key interventions to address one of the most critical climate risks for Bursa.



IMPACT ON GHG EMISSION REDUCTION

No impacts.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The action can consider data-driven and GIS-based spatial analysis to assess heat risk and explore suitability of solutions. For example, remote sensing could be utilised to localise heat risk and identify hotspots across the city that require intervention.



IMPACT ON NATURAL CAPITAL VALUE

Indirect impacts – If nature-based interventions in the Action Plan are implemented, the climate regulation value of local ecosystem services is expected to be enhanced.



Eskikaraağaç Stork Village, Karacabey

Implement nature-based solutions along urban rivers

Implement a pilot project that utilises nature-based solutions to address flood risk along urban rivers and locate additional opportunities for similar interventions.

RELEVANT THEMES

#landuse

#NBS

#G&EI

#NCV

#climate&environment

#resilience



Capital Investment (Project)
Strategy / Plan / Study



BMM Department of Parks and Gardens
BUSKI
Nilüfer District Municipality



Bursa wide, **pilot in Nilüfer District**



New



Medium (2-5 years)



€ 700,000 Development/advisory costs
€ 3,210,000 Capital costs
€ 321,000 Operational costs (over 5 years)



Direct Climate Resilience
Direct GHG Emissions
Direct G&EI
Indirect Smart
Direct NCV - €987,059 annual NCV impact



ACTION 3 Undertake urban redevelopment along planned metro lines

ACTION 30 Develop a 'River Depollution Roadmap' for the Nilüfer Stream



Land Use – Per capita green space across each urban district is greater than 15 m².

Land Use – 70% of the population can access a park/green space within 15 min (walk, cycle or public transport trip)

Water – 100% of the municipal population is served by a wastewater treatment plant.

Climate & Environment – Greater than 25% of length of channelised streams are replaced with nature-based solutions for mitigating flood risk.

Climate & Environment – Tree canopy cover in each district is greater than 20%.



3 – Good Health and Well-being
5 – Gender Equality
11 – Sustainable Cities and Communities
13 – Climate Action
14 – Life Below Water
15 – Life on Land

The loss of natural areas and green spaces in the urban core and near industrial areas emerged as a priority challenge for the Land Use sector by Bursa stakeholders. Moreover, pollution in rivers and streams due to industrial activity and the increased risk from river and surface water flooding due to climate change emerged as key challenges for the Climate and Environment sector, with several areas across the city already identified as being vulnerable to flooding.

Current regulation and flood protection measures implemented by DSI focus on the concrete channelisation of rivers and streams running through urban areas. However, in more recent times this method has been shown to be ineffective when dealing with extreme rainfall events as a result of climate change, reduced natural water retention and drainage capacity, leads to loss of biodiversity and degraded ecological conditions as well as limits access to urban waterfronts for citizens. Globally, the re-naturalisation of urban river channels and the implementation of NbS have emerged as a more appropriate solution to managing urban and surface water flooding in cities. For example, Los Angeles, USA, has embarked on a major project to revitalise the Los Angeles River running through the dense centre of the City¹⁰⁴. As part of this effort, amendments to the Water Resource Development Act of 1992 were authorised to allow for the project and include measures for environmental restoration and revitalisation of urban rivers¹⁰⁵.

Therefore, **this action looks to integrate river re-naturalisation and NbS approach to addressing challenges by retrofitting a section of the Nilüfer Stream and nearby prominent public spaces.** By integrating NbS into urban flood management, this action aims to restore natural water retention capacity and ecological function in flood-prone areas, while increasing the availability of quality green spaces in the urban core.

COMPONENTS

1 DEVELOPMENT OF AN OPPORTUNITIES STUDY TO IDENTIFY LOCATIONS FOR IMPLEMENTING RIVER RE-NATURALISATION AND GREEN INFRASTRUCTURE ALONG BURSA'S URBAN RIVERS

An assessment should be conducted to identify locations across the city where river re-naturalisation and NbS interventions can mitigate flood risk and enhance ecological resilience. The study will prioritise flood-prone areas, particularly near wastewater



Figure B17: Los Angeles River, before and after implementation of nature-based solutions for flood mitigation

Source: Yale Environment360 (https://e360.yale.edu/features/photos_restoring_the_los_angeles_river)

treatment plants, industrial zones, and heavily urbanised districts where impermeable surfaces exacerbate drainage issues. It will include the following topics:

- **Baseline assessment and risk mapping** - Conduct hydrological and climate risk studies to identify flood-prone areas, runoff patterns, and erosion risks along key watercourses, alongside a status quo analysis of stream channelisation, focusing on the degree of concrete encasement and ecological degradation.
- **Site selection and framework development** - Develop a framework for identifying NbS sites based on criteria such as flood vulnerability, ecological potential, urban heat mitigation needs, pollution sources such as wastewater treatment plants, and community access.
- **Concept design and policy alignment** - Prepare concept design schemes for prioritised sites, showcasing different NbS typologies such as re-meandering, vegetated swales, riparian buffers, green corridors, artificial wetlands and reedbeds for pollution filtration. Simultaneously, develop recommendations for policy and regulatory adjustments to support NbS delivery through zoning amendments, and inclusion in flood mitigation or open space strategies.
- **Financing and implementation readiness** - Identify suitable funding and financing opportunities for the prioritised sites, including climate adaptation funds,

national water resilience programmes, EU or international development funds, and private investment.

Based on stakeholder engagement some initial locations have been identified, including: Ayvalı Stream (Özlüce), Gümüştepe (Nilüfer), Doğancı Dam (Osmangazi) and Dereköy (Mudanya).

2 PILOT RIVER RE-NATURALISATION AND GREEN INFRASTRUCTURE IMPLEMENTATION

River re-naturalisation and the implementation of green infrastructure should be piloted in one of the following locations and include:

- **River re-naturalisation and hydrological restoration** – Remove concrete channel linings where feasible, informed by detailed hydraulic modelling, to restore natural hydrological functions in the area, whilst reintroducing meanders or flow variation to slow down water movement and improve retention. Restore riparian buffers with native vegetation to stabilise banks, reduce erosion and enhance biodiversity.
- **Green infrastructure, NbS and flood management solutions** – Install restorative constructed wetlands along the streams, such as the mycelium floating wetlands¹⁰⁶, to filter pollutants, enhance water storage, and improve water quality. Introduce floodable parks on the embankment of the stream with bio-swales, and permeable surfaces to absorb runoff and mitigate urban drainage issues.

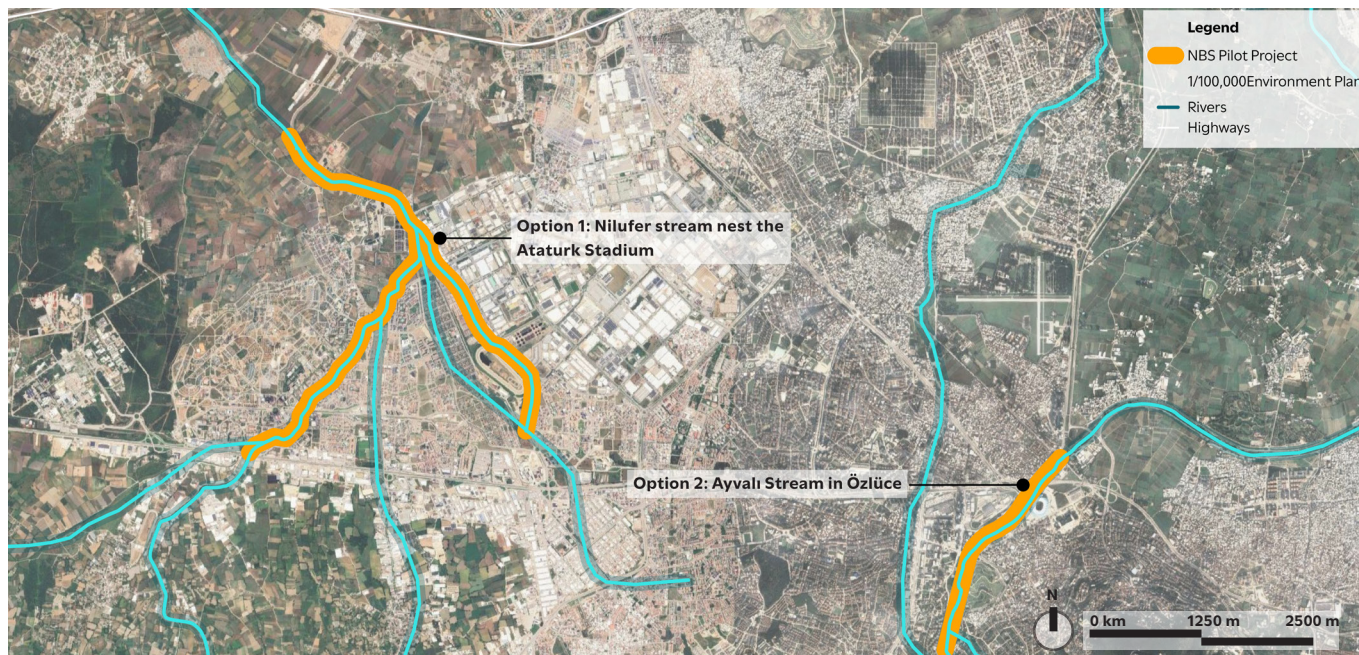


Figure B18: Map showing the pilot options for Component 2

Sources: AtkinsRéalis analysis

- **Public realm and recreational space enhancement** – Develop pedestrian-friendly pathways and river access, with seating areas, viewing platforms and educational signage to raise awareness surrounding NbS benefits and urban flood resilience. Install street landscaping and rain gardens around the public realm. In addition, facilitates improved pedestrian access, including delivering uniform surfaces and ramps for wheelchair users and people with prams.

Two options for the pilot with their respective advantages and disadvantages are summarised below:

Option 1: Nilüfer stream, near the Atatürk Stadium

One of the identified flooding hotspots by AFAD is near the Ataturk Stadium, which hosts the local football team (BursaSpor) and attracts many city residents on match days. This stretch of the Nilüfer Stream already has public open spaces like the Hüdavendigar City Park located alongside, which could be redeveloped to include NbS infrastructure.

Advantages	Disadvantages
Prominent location visited by many people which can demonstrate the benefits of river re-naturalisation and green infrastructure to many.	Located in a densely built-up area with limited space for intervention along some points of the river which will require smart design.
Identified as a key flooding hotspot which could benefit from the implementation of green infrastructure.	Difficulties in navigating regulations to remove concrete channelisation of the river.
Opportunity to utilise NbS to assist with crowd control around the stadium and metro station, in particular during busy periods.	Potential in higher implementation costs.

Option 2: Ayvalı Stream in Özlüce

A stretch of the Ayvalı Stream runs through the Özlüce residential area in Nilüfer District. It is unclear if this area is susceptible to urban flooding due to the lack of detailed flood maps developed by AFAD.

Advantages	Disadvantages
Located in a more rural setting with several areas of open land possible for use to re-naturalisation and implement green infrastructure.	Less prominent public space.
Near to Wastewater Treatment plants and OIZs whereby NbS could help to filter water and increase quality.	Offers limited opportunities to demonstrate effectiveness as the river channel has not been fully concreted.
Potential for lower implementation costs.	

TIMELINES

COMPONENT 1:

0–3 MONTHS

Carry out an assessment of current flood management infrastructure in Bursa, including a review of existing policies, governance protocol, implementation and monitoring processes, and performance of infrastructure during flood events. A digital and GIS approach should be taken to inform the assessment.

0–3 MONTHS

In parallel, **develop a menu of nature-based interventions suitable for Bursa**, based on the local environment, biodiversity and climatic context. The menu should identify potential benefits, suitable conditions for implementation, indicative implementation mechanisms, and costs compared to the business-as-usual intervention.

3–12 MONTHS

Carry out a city-wide spatial assessment to identify suitable sites for NbS interventions to address flood risk, using hydrological modelling, climate risk mapping, identification of land ownership/land assembly requirements, and stakeholder input. From the assessment, identify priority sites based on the extent of flood risk and readiness to implement interventions.

12–18 MONTHS

For priority sites, develop high-level concept plans that build on the menu of interventions and city-wide assessment. The development of concept plans should include additional site-based assessments and further details on stakeholder engagement and delivery mechanisms. In addition, a **roadmap to integrate concept plans into relevant development plans and climate resilience policies** should be developed.

COMPONENT 2:

0–6 MONTHS

Conduct a detailed site and feasibility study, including a hydraulic model, of the pilot areas, define requirements for selected site in consultation with local stakeholders. A digital and GIS approach should be taken to inform the assessment.

6–12 MONTHS

Organise a concept design competition to develop a public realm masterplan for the pilot area, select winning schemes. The brief for the design competition

will be based on the site and feasibility study.

12–36 MONTHS

Finalise detailed design for the pilot area in consultation with the private sector partner and stakeholders.

36+ MONTHS

Begin phased implementation of NbS interventions in the pilot area, including concrete removal, buffer restoration, and green infrastructure installation. Monitor hydrological impacts throughout the process.

IMPLEMENTATION



IMPLEMENTATION CONSIDERATIONS

- While most of the area identified for the nature park by the stadium consists of publicly-owned land, a **clear understanding of existing land ownership and a strategy for land assembly must be developed** to minimise barriers or delays to implementation.
- The delivery of the nature park will **require close collaboration with owners/operators of Atatürk Stadium and significant public engagement** for successful adoption, community acceptance and long-term stewardship.
- **A management plan is needed to sustain and expand the impact of NbS interventions.**
- **Development of a hydraulic model** to understand interactions of flood water with the surrounding landscape will be needed to mitigate unintended consequences on exacerbating flooding in other areas along the stream as a result of this scheme.



KEY STAKEHOLDERS

- **BMM Department of Parks and Gardens – Implementation Agency** – All Components and Steps.
- **BUSKI** - Implementation Agency - All Components and Steps.
- **Nilüfer District Municipality** – Implementation Agency – All Components and Steps.
- **BMM Department of Environmental Protection and Control** – Involve and Collaborate – All Components and Steps.
- **BursaSpor**– Involve and Collaborate – Component 2.

- **Owners of the Atatürk Stadium and surrounding public realm** – Involve and collaborate – Component 2 and all steps.
- **BMM Department of information Technology** – Involve and collaborate – Step 1 of Component 1 and 2.
- **AFAD** - Consult – All Components and Steps.
- **Academia & Research Institutions** – Collaborate – Steps 1, 2, 4
- **Private Sector & Developers** – Collaborate – Steps 2, 3
- **Local residents** – Inform and Consult – Steps 2, 4



POTENTIAL FUNDING AND FINANCING SOURCES

- **Own Source** – BMM budget assigned to public space creation and maintenance.
- **Grant** – National government, IFIs (for project preparation) and development organisations.
- **Private Investment** - Corporate Social Responsibility (CSR) funds for park upgrades and maintenance.
- **Climate financing** – from various programmes targeting climate mitigation and adaptation initiatives. This could also include Green and sustainability linked bonds, however this would require further regulatory maturity of the bond market.



REVENUE GENERATION OR COST SAVING OPPORTUNITIES



No

No direct revenue generation or cost saving opportunities as a result of this action.

IMPACT



GENDER AND ECONOMIC INCLUSION CONSIDERATIONS AND CO-BENEFITS

Direct benefits – The action will improve the quantity and quality of green space available to all residents in Bursa, and will result in improvements in air and water quality and improve heat resilience, thereby benefiting all communities in the local area. The design of green spaces and nature-based solutions should enable accessibility for women, the elderly, and underserved groups. Opportunities to involve women, youth, and disadvantaged groups in design implementation and maintenance should be maximised – for example, by engaging local women's cooperatives in seedling production and landscape maintenance.



CLIMATE AND DISASTER RESILIENCE CONSIDERATIONS AND CO-BENEFITS

Direct benefits – This action will strengthen flood resilience by restoring the stream's natural capacity to absorb and regulate water flow, reducing surface water flooding during heavy rainfall and extreme weather events. Constructed wetlands and sustainable drainage solutions like bio-swales will act as natural buffers during high discharge times, improving the resilience of urban drainage systems. Increased green cover will help combat extreme heat by lowering temperatures and improve groundwater recharge. Reintroducing native vegetation will boost biodiversity, improve air quality, and create habitats for local wildlife.



IMPACT ON GHG EMISSION REDUCTION

Direct impacts – While not quantifiable at this stage, this action is expected to lead to notable GHG emission reduction, mainly as a result of carbon sequestration by trees planted as part of any nature-based solutions.



SMART MATURITY CONSIDERATIONS AND CO-BENEFITS

Indirect benefits – The action can consider digital or smart technology-driven approaches such as GIS and hydrological modelling, to aid the design and delivery of any proposed NbS schemes.



IMPACT ON NATURAL CAPITAL VALUE

Direct impacts – The key focus of this action is re-naturalising the river which will enhance flood regulation service. Nature-based solutions will improve the water quality service, and contribute to improvements in local climate regulation and flood regulation. Through interventions to improve access to the river, the value of recreation and health and wellbeing services will be enhanced.

Estimated annual NCV impact: €987,059

Ecosystem service impacts estimated using bottom-up approach. This action is likely to have positive impacts on global climate regulation (€354,794), recreation (€536,249), flood regulation (€94,046), and water quality (€1,970).

104. <https://lariver.lacity.gov/>

105. <https://www.congress.gov/bills/109th-congress/senate-bill/2667>

106. [Mycelium wetlands: Artificial wetlands composed of floating, root-like fungal fibers \(mycelium\), used to remove pollutants from water and support the ecosystem.](#)



Nilüfer Stream flowing through Hüdavendigar Park

Other Actions

On its journey towards a more sustainable and resilient future, Bursa can also consider developing and implementing the actions included in this section that also address its environmental challenges. These actions were identified during the GCAP development process but were not prioritised for further development.





Hanlar Region, Osmangazi



LAND USE

Action title	Description	Action Type	Implementing Agency	Implementation Timeframe
Establish community working groups for the co-design of social infrastructure through participatory workshops and feedback sessions.	These groups would engage local residents, stakeholders, and professionals to ensure that the infrastructure reflects community needs and preferences. The programme would include structured workshops to gather input, collaborative design activities, and follow-up sessions to refine proposals and achieve consensus. A pilot programme could be the ongoing Karapınar - Değirmenönü - Cumalıkızık Urban Transformation Project. (e.g., health clinics, schools, market spaces).	Strategy / Plan / Study	District Municipalities	Short (<2 years)
Conduct a review of spatial plans and regulations across authorities at different scales and regions to ensure consistency.	This action looked to consolidate national, metropolitan and district regulations/guidelines that impact land use and urban development.	Capital Investment (Project)	BMM Department of Zoning and Urbanisation	Short (<2 years)
Implement community heritage grants for local preservation initiatives.	This action involved establishing a programme to provide micro-grants and technical support for locally proposed restoration projects. The grants would fund small-scale preservation efforts, focusing on community-driven initiatives to restore and maintain heritage sites, historic buildings, and culturally significant areas. Technical support would ensure that restoration projects adhere to best practices and relevant regulations.	Capital Investment (Project)	Bursa Culture and Tourism Directorate	Short (<2 years)
Implement a program for the identification, monitoring, restoration and protection of historical and cultural assets.	This action involved establishing a structured framework to identify and catalogue historical and cultural assets, regularly monitor their condition, and undertake necessary restoration and protection measures. The programme would include detailed surveys and the development of guidelines to ensure restoration works adhere to heritage conservation standards and relevant regulations.	Capacity-building / Awareness Programme	Bursa Culture and Tourism Directorate	Short (<2 years)
Create a climate-resilient coastal park in Gemlik to serve not only as a recreational and social space, but designed with features to capture, store and release stormwater.	This action involved the creation of a coastal park designed to function as both a recreational and social space while incorporating features to capture, store, and release stormwater. The park's design would include floodable areas, retention basins, and permeable surfaces to manage stormwater during extreme weather events.		BMM Department of Parks and Gardens	Long (> 5 years)
Implement a program integrating renewable energy exercise parks within open and green spaces across the city, equipped with kinetic-powered equipment and solar panels.	The parks would harness energy generated by users to power lighting, charging stations, or other park facilities. Drawing inspiration from the Kinetics Energy Playground showcased during Singapore Design Week, these parks will combine fitness, recreation, and sustainable energy production.	Strategy / Plan / Study	BMM Department of Parks and Gardens	Medium (2-5 years)
Develop a program to integrate sustainable agricultural techniques in Kestel as a pilot neighbourhood.	Implement a program to rehabilitate and re-activate productive agricultural land proactively, whilst identifying and afforesting suitable areas through GIS and remote sensing technologies.	Capital Investment (Programme)	Agriculture Landscape Inc. / Provincial Directorate of Agriculture and Forestry	Medium (2-5 years)



BUILDINGS

Action title	Description	Action Type	Implementing Agency	Implementation Timeframe
Develop an action plan aiming to improve compliance with building codes and establish incentives for compliance.	This action focused on creating a comprehensive plan to enhance compliance with building codes, particularly in relation to structural safety and earthquake resistance. The plan would address the current lack of mandatory earthquake certification and inspections, outlining potential mechanisms for their implementation and enforcement. It would also include the development of incentive schemes, such as financial subsidies or reduced permit fees, to encourage compliance among property owners and developers.	Strategy / Plan / Study	'BMM Department of Zoning and Urbanisation BMM Department of Real Estate and Expropriation	Short (<2 years)
Implement retrofitting programs for residential and commercial buildings to improve energy efficiency and resilience.	This action would assist in the delivery of nearly net-zero buildings, including insulation upgrades, installation of cool roofs, cool walls etc.	Capital Investment (Programme)	'Ilbank & BMM Department of Zoning and Urbanisation	Medium (2-5 years)



INDUSTRIES

Action title	Description	Action Type	Implementing Agency	Implementation Timeframe
Implement a programme to help industries develop industrial resilience and adaptation plans focusing on earthquake risks and climate hazards.	Set up a programme to provide grants for industries interested in developing resilience and adaptation plans in line with EU regulatory requirements. A focus of the plans could be outlining actions that could be strong contenders for IFI financing for implementation.	Strategy / Plan / Study	Bursa Eskisehir Bilecik Development Agency	Short (<2 years)
Undertake a feasibility study to develop a heat recovery / heat sharing plant in OIZs	This action would seek to identify a location to implement a heat recovery plan and associated district heating network in a OIZ in Bursa. This would include undertaking an energy audit to identify potential sources and consumers of heating/cooling and would depend on the types of industries present. The action would also identify potential efficiencies to help reduce heat generation and consumption.	Strategy / Plan / Study	TEIAS	Short (<2 years)
Develop large scale solar PV installation on empty/disused plots in a OIZ in Bursa.	This action sought to decarbonise an OIZ's electricity use by developing a large-scale solar PV installation on an empty/disused plot. This action would need to include a site selection study to understand which OIZ in Bursa is best placed for such an intervention.	Capital Investment (Project)	Individual OIZs	Long (> 5 years)
Develop an 'Innovation Centre' to explore sustainable production practices for the Technology OIZ in Karacabey District.	This action sought to leverage the development of the Technology OIZ and its targeted modern industries, such as, medicine production, aerospace and transport, nanotech, etc. to develop sustainable production processes which can be applied to the OIZ in question as well as other OIZs and industries across Bursa.	Strategy / Plan / Study	Technology OIZ	Short (<2 years)

Develop the Textiles Dyehouse specialised OIZ in Nilüfer District to become a Green OIZ.	Invest in the necessary infrastructure to ensure the Textiles Dyehouse specialised OIZ in Nilüfer District complies with Green criteria and implements actions identified as part of the Bursa Green OIZ Action Plan. These include energy, water and manufacturing process efficiency measures. This should ensure the OIZ has minimal impact on the local environment when fully operational. This action should also include measures to enhance collaboration between the industries and improve social and gender outcomes, for example, improved working conditions.	Capital Investment (Project)	Textiles Dyehouse specialised OIZ	Medium (2-5 years)
Develop a retrofitting programme to implement water efficiency measures in existing and new large industrial buildings (50+ employees).	This actions sought to develop a retrofitting programme to implement water efficiency measures, including grey water reuse, rain water harvesting, in-plant controls, etc., in large industries (classified as 50+ employees by regulation). Greywater is mainly generated from bathrooms, sinks, kitchens and washing machines. In those kinds of large-scale industries, greywater can be reused for garden irrigation, fire extinguisher, toilet flushing, etc.	Capital Investment (Programme)	Individual OIZs or industries BUSKI BMM Department of Environmental Protection and Control	Medium (2-5 years)



TRANSPORT

Action title	Description	Action Type	Implementing Agency	Implementation Timeframe
Create 'Green Oases' at transit hubs through micro-parks, community gardens, and greening underused parking lots.	This action focused on transforming underutilised spaces at transit hubs into vibrant, green, and disaster-resilient areas. It involved the development of micro-parks, community gardens, and the conversion of parking lots into green spaces. Inspired by initiatives in Istanbul and Paris, the project will integrate renewable energy systems, open areas for disaster response, and sustainable landscaping features to enhance urban resilience.	Capital Investment (Project)	BMM Department of Parks and Gardens	Short (<2 years)
Install EV charging infrastructure at key transit points, parking lots and depots to support clean energy private vehicles.	Building on several initiatives across the city, this action would expand EV charging infrastructure at parking lots, street parking spots, and public buildings to encourage a transition to electric private vehicles.	Capital Investment (Project)	BMM Transport Department	Medium (2-5 years)

Action title	Description	Action Type	Implementing Agency	Implementation Timeframe
Strengthen and adapt local regulation in line with new National Water Efficiency Regulation (2024).	Technical support to BUSKI and BMM to implement the new Water Efficiency Regulation (2024). The main actions would include reviewing water tariffs to enable a push towards building owners to implement such infrastructure and use alternative water as opposed to fresh water. In addition, specific building codes and design guidelines should be developed to help architects, developers and building owners understand how to implement, for example, rainwater harvesting on new buildings with roofs over 2,000 m ² in area or grey water re use infrastructure in new buildings.	Policy / regulation	BUSKI	Short (<2 years)
Separate combined sewer systems and develop infrastructure to capture, store and treat storm water runoff, to be used for irrigation of open green spaces and farms.	Increase alternative water sources by harnessing stormwater. 80% of stormwater and wastewater pipelines the city centre of Bursa are already separated, which is an advantage. This would also reduce wastewater flow rate to WWTPs, increasing their efficiency and capacity and potentially reducing operation cost and GHG emissions.	Capital Investment (Project)	BUSKI	Medium (2-5 years)
Monitor and regulate groundwater extraction.	Creation of an inventory focusing on groundwater extraction in Bursa which builds upon any registers held by the DSI. Determining which extraction sources to monitor and regulate will be based on quantity and rate of extraction, location of extraction and equipment used as per regulation. This should focus on industries, and mandate metering of pumps above a certain capacity threshold. Illegal consumption extraction and consumption should be controlled with stricter penalties applied to breaches in regulation.	Policy / regulation	State of Hydraulic Works (DSI)	Short (<2 years)
Pilot the deployment of shade balls on ponds and irrigation pools.	There are around 100 ponds and irrigation pools managed by BUSKI across the Province. This action sought to deploy shade balls on a handful of these, as a pilot project, to help reduce evaporation of water and therefore increase the availability of water for irrigation purposes.	Capital Investment (Project)	BUSKI	Medium (2-5 years)
Undertake a study to determine the condition of existing dams and opportunities to increase capacity of reservoirs.	Develop an understanding of opportunities to increase the capacity of potable water reservoirs across the province, for example, through desilting, raising dams or moving abstraction points.	Strategy / Plan / Study	State of Hydraulic Works (DSI)	Short (<2 years)
Develop an infrastructure network for grey water reuse and rainwater harvesting in the Textile Dyehouses Specialised OIZ in Nilüfer District.	Implement water efficiency and alternative water uses in the Textile Dyehouse Specialised OIZ in Nilüfer District before industries start to move in. This will ensure water from such industrial uses is sustainably managed and the impact on water quality and quantity is reduced.	Capital Investment (Project)	Textile Dyehouses Specialised OIZ	Medium (2-5 years)

Action title	Description	Action Type	Implementing Agency	Implementation Timeframe
Develop a long-term resilience and modernisation plan for the electricity generation and distribution network	Develop a business case for subsequent energy actions in the long list, most notably the adaptation and resilience programme. It is an important step in adapting the generation and distribution network to changing electricity demands, for example, due to increased adoption of electric cars or implementation of heat pumps.	Strategy / Plan / Study	EUAS, TEIAS & UEDAS	Short (<2 years)
Undertake a comprehensive energy (heat and electricity) audit of industries	Develop a business case for subsequent energy and industry actions in the longlist, most notably the heat recovery plant and district heating networks.	Strategy / Plan / Study	Bursa Provincial Directorate of Industry and Technology & BTSO	Short (<2 years)
Retrofit the Doğançı potable water dam to generate electricity.	The Doğançı Dam has a potential for 1.25 MW, as determined by the following study - "Electricity Generation From Existing Multipurpose Dams in Türkiye". However, further exploration is required as if the dam is used for irrigation purposes it may not be appropriate to retrofit to generate energy.	Capital Investment (Project)	EUAS	Long (> 5 years)
Retrofit the Çınarcık dam and Ulubat Hydro Electric Power plan to work as a pumped hydro storage facility.	Retrofit the existing infrastructure to function as a pumped hydro storage facility, helping to balance the network loads as demands change during the day.	Capital Investment (Project)	EUAS	Medium (2-5 years)
Undertake a feasibility study of further potential for pumped hydro storage facilities.	Identify additional pumped hydro storage facilities across the Province, given its geography and proximity to water sources, including the Sea of Marmara and multiple lakes.	Strategy / Plan / Study	EUAS	Short (<2 years)
Pilot the implementation of a decentralised microgrids for a rural centre, including undertaking a site selection study.	Decentralise the energy distribution network helping to build resilience in the event of a climate or natural hazard and were the connection with the national grid was disturbed. However, It is understood that current regulations would not allow for the implementation of decentralised energy networks, which would be a major barrier to this action.	Capital Investment (Project)	TEIAS	Long (> 5 years)
Establishing an Energy Task Force.	Increase the collaboration between BMM and energy generation and distribution companies. Such a task force could meet regularly to discuss energy infrastructure and development in BMM or biannually to facilitate high-level information exchange. This would help to align infrastructure programmes and investment to decrease duplication of work. However, establishing such a task force could be challenging due to the existing regulatory and institutional set-up where the private energy companies are contracted by the national government and may not want to interact with BMM on this basis.	Capacity-building / Awareness Programme	BMM Department of Environmental Protection and Control	Short (<2 years)



CLIMATE AND ENVIRONMENT

Action title	Description	Action Type	Implementing Agency	Implementation Timeframe
Improve monitoring of sea levels, storm surge events, tidal activities and sea surface temperatures.	Monitoring of sea levels and tidal activities, especially at the stormwater outlets and effluent discharge points	Data / Monitoring System	Bursa Provincial Directorate of Environment, Urban Planning and Climate Change & Bursa Provincial Directorate of Agriculture and Forestry & BUSKI	Short (<2 years)
Pilot the implementation of catchment management solutions along, upper, mid and downstream areas of river basins.	Implementation of catchment management solutions along rivers in Bursa, in particular through land use rationalisation, creation of buffer zones, tree planting, artificial wetlands, etc. The solutions can be upstream near dams and water reservoirs to increase the holding capacity or downstream to accommodate seawater and enhance natural treatment of water before it is discharged in the Sea of Marmara, for example, at the Kocaçay Delta.	Capital Investment (Project)	Bursa Provincial Directorate of Environment and Urbanization and Climate Change, DSI	Long (> 5 years)
Initiate a People's Biodiversity Register.	Involve citizens and NGOs in biodiversity mapping and data collection. It will improve data on biodiversity and generate awareness amongst citizens.	Data / Monitoring System	Universities	Short (<2 years)
Develop a capacity-building program for farmers to educate and raise awareness about the use of fertilizers and pesticides.	Development of Bursa-specific capacity building programme to raise awareness and educate farmers about the use of quality and quantity of fertilizers and pesticides. The action has the scope to involve private sector entities who already play a part in such activities on a national level.	Capacity-building / Awareness Programme	Ministry of Agriculture and Forestry BMM Department of Rural Services Tarım A.Ş. Private fertilizer and pesticide manufacturer	Short (<2 years)



Appendix

Appendix A

Estimated Costs for Implementation

This note provides a overview of assumptions and calculation approach to estimate indicative costs for implementation of the Green City Actions in this GCAP. The costs associated with each Action include:

- **Development/Advisory Costs:** These represent the upfront investment required for planning, design, stakeholder engagement, and technical advisory services necessary to bring each Action to implementation readiness.
- **Capital Expenditure (CAPEX):** This includes the estimated costs associated with, for example, the procurement, construction, and installation of infrastructure or assets required to deliver the Action.
- **Operational Expenditure (OPEX):** This outlines the anticipated costs of operating, maintaining, and monitoring each action over a five-year period following implementation.

Where appropriate the costs for the Action have been disaggregated by its components (as outlined in the Action Card). For Actions without distinct components, costs have been disaggregated using key activities or elements required to facilitate their implementation.

The costs have been informed by assumptions, expert judgment and relevant local and international benchmarks. Estimated costs for all Green City Actions have been validated with Sectoral Stakeholder Groups during technical meetings held 20-22 May 2025. These may be subject to refinement as the scope for individual Actions evolves, or as further feasibility studies are undertaken.

ACTION 01

Develop a 'City Guide'

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment/assumption	Source
Component 1: 'City Guide' development	-	250,000	-	-	Expert judgment.
Server and network infrastructure	-	15,000	-	Server and network infrastructure average between \$5k - \$20k.	https://blog.servermania.com/database-hosting-cost .
Component 2: Awareness building and digital skills development	-	-	50,000	Also includes maintenance over 5 years.	Expert judgment.
Total	-	265,000	50,000		

ACTION 02

Develop neighbourhood-scale urban transformation strategies

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Planning and governance framework	500,000	-	-	Assumed for 5 Urban Transformation Sites stated under Article 73 and Law No.6306.	Expert judgment.
Component 2: Urban Transformation Strategies	500,000	-	-	Assumed for 5 Urban Transformation Sites stated under Article 73 and Law No.6306.	Expert judgment.
Total	1,000,000	-	-		

ACTION 03

Undertake urban redevelopment along planned Metro lines

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Project preparation (feasibility, due diligence, site selection, master planning, etc.)	450,000	-	-	-	Expert judgment.
Acquiring necessary development permits and agreements with contractors. Land renegotiation and resettlement of residents.	150,000	-	-	-	Expert judgment.
Cycle lanes	-	2,000,000	-	Assumed 10km at €200k per km.	https://dergipark.org.tr/tr/download/article-file/911762
Paving and surfacing	-	2,000,000	-	Assumed 20km at €100k per km.	Expert judgment - assuming half the cost of Cycle lane
Landscaping, green spaces and public realm improvements,	-	700,000	-	Assumed 1 ha at €700k per ha.	https://publications.parliament.uk/pa/cm201011/cmselect/cmcomloc/writev/regeneration/m65.htm
Development of mixed used buildings and affordable housing	-	425,000,000	-	Assumed 85k housing units at €5k per housing unit.	https://acaryp.com/en/cost-of-building-house-in-turkey-2025/#:~:text=The%20cost%20to%20build%20a%20house%20in%20Turkey%20typically%20ranges,have%20detailed%20project%20drawings%20created.https://www.hurriyetdailynews.com/house-sizes-continue-to-shrink-nationwide-203168#:~:text=On%20the%20other%20hand%2C%20the,11%20square%20meters%20in%202020.
Maintenance and operation costs	-	-	235,000	OPEX assumed at 2% of CAPEX.	Expert judgment.
Total	429,700,000	600,000	235,000		

ACTION 04

Establish green belts around OIZs

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 3: Design guidelines for the green belt	250,000	-	-	Does not include costs associated with land acquisition.	Expert judgment.
Total	250,000	-	-		

ACTION 05

Transform existing industrial area in Kestel or Gürsu Districts.

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Identification of Suitable Industrial Area and Relocation Support Programme	250,000	3,000,000	-	Assuming an average of €50k per industrial unit that needs to be relocated. Assuming relocation of 60 industrial units at around 0.5 ha. Includes Project preparation (feasibility, due diligence, site selection, masterplanning, etc.) and activities for land parcel acquisition.	Expert judgment.
Component 2: Transformation Planning and Implementation	350,000	21,000,000	1,050,000	Assumed cost of public real development at 700k per ha based on range of £600k-£3 million in the UK between 2001/2009. Assumed 30ha of public realm improvements and green space development. OPEX assumed at 2% of CAPEX.	Expert judgment. https://publications.parliament.uk/pa/cm201011/cmselect/cmcomloc/writev/regeneration/m65.htm
Total	600,000	24,000,000	1,050,000		

ACTION 06

Develop a digital database for buildings

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 4: Rollout of city-wide smart meter programme	-	900,000	-	Assumed 5k smart meters at €180 per smart meter.	https://energy.ec.europa.eu/topics/markets-and-consumers/smart-grids-and-meters_en#:~:text=Furthermore%2C%20it%20was%20estimated%20that,distribution%20system%20operators%2C%20etc.)
Component 5: Digital Building Database and Management System	-	265,000	50,000	Server and network infrastructure average between \$5k - \$20k. OPEX assumed at 2% of CAPEX.	Expert judgment. https://energy.ec.europa.eu/topics/markets-and-consumers/smart-grids-and-meters_en#:~:text=Furthermore%2C%20it%20was%20estimated%20that,distribution%20system%20operators%2C%20etc.)
Total	-	1,165,000	50,000		

ACTION 07

Enhance structural integrity and energy efficiency in new and existing buildings

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1 - Enhanced compliance mechanisms for new constructions	1,250,000	-	-	Assumed 5,000 EPC certificate. Costs range with most common properties ranging around €250.	https://www.certigera.pt/en/the-cost-of-an-energy-performance-certificate
Component 2 - Incentive programme for existing buildings	2,500,000	-	-	Assumed 10,000 EPC certificate Costs range with most common properties ranging around €250.	https://www.certigera.pt/en/the-cost-of-an-energy-performance-certificate
Total	3,750,000				

ACTION 08

Implement sustainability and resilience interventions in BMM-owned buildings.

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Project preparation (feasibility, due diligence, site selection, etc.)	400,000	-	-	-	Expert judgement.
Component 1: Retrofit buildings with low-emission energy solutions	-	2,600,000	260,000	Assuming 100 buildings at €26k each. OPEX assumed at 2% of CAPEX.	https://thermolock.com/en/media/blog/thermal-insulation-provides-under-invoicing
Component 2: Implement renewable energy generation measures	-	900,000	90,000	Assuming 100 buildings at €9k each. OPEX assumed at 2% of CAPEX.	https://cw-enerji.com/en/cw-enerji-library/solar-panel-price-for-a-house-installation-and-calculation-24
Component 3: Implementing Resilience Hubs	-	650,000	65,000	Assuming 100 buildings at €6.5k each. OPEX assumed at 2% of CAPEX.	https://www.uia-initiative.eu/en/uia-cities/paris-call3
Total	400,000	4,150,000	415,000		

ACTION 09

Deploy a low-emissions heating programme for residential buildings

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Programme preparation (feasibility, due diligence, site selection, etc.)	200000	-	-	-	Expert judgment
Low carbon heating infrastructure	-	70,000,000	-	Low end range in the UK £12k - £12k = ~€ 14k Assuming 5000 full installations accounting for around 10% of the 4% of low-income households reliant on coal for heating.	https://www.evergreenenergy.co.uk/heat-pump-guides/much-heat-pump-cost/#:~:text=Heat%20pump%20prices%20vary%20considerably,between%20%C2%A37%2D%C2%A310%2C000
Total	200,000	70,000,000			

ACTION 10

Develop a 'Net Zero Carbon Industries Action Plan'

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Development of 'Net Zero Carbon Industries Action Plan'	1,000,000	-	-	-	Expert judgment.
Total	1,000,000	-	-		

ACTION 11

Set up a 'Sustainable Industries Help Desk'

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Help desk set up costs	50,000	-	-	-	Expert judgement.
Cost per TA assignment	-	-	750,000	-	Assume average cost of delivering 1 TA assignment.
Total	50,000	-	750,000		

ACTION 12

Develop an industrial waste recycling facility

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Industrial hazardous and non-hazardous waste stream study	200,000	--	-	-	Expert judgment
Component 2: Industrial Waste Recycling Facility	300,000	10,000,000	1,600,000	Industrial Waste Recycling facility Project preparation (feasibility, due diligence, site selection, etc.). Industrial waste recycling facility (piloting textiles as its first waste stream). Staffing costs (Assumed average yearly salary of an employee in Türkiye of around €12k). OPEX assumed at 2% of CAPEX.	Expert judgment.
Total	500,000	10,000,000	1,600,000		

ACTION 13

Expand the metro / light rail network

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Implementation of the Metro line 4 proposed as part of the TMP 2035	2,000,000	851,600,000	212,900,000	Project preparation (feasibility, due diligence, site selection, etc.). Assuming 21km of Metro at around €40.5 million per km. OPEX assumed at 5% of CAPEX.	Based on similar projects from GCAP Gaziantep and GCAP Istanbul BMM feasibility Study Expert judgment.
Component 2: Fleet expansion and modernisation	-	117,800,000	29,440,000	Project preparation (feasibility, due diligence, site selection, etc.). Assuming 48 LRT vehicles at €2.45 million each. OPEX assumed at 5% of CAPEX.	BMM feasibility Study Expert judgment.
Component 3: Transfer hubs and park-and-ride facilities	3,000,000	5,600,000	560,000	Project preparation (feasibility, due diligence, site selection, etc.). Assuming 6 transfer hubs at around 500k each, and 6 park & ride locations at around €400k each. Additional €200k for implementation of smart technology. OPEX assumed at 2% of CAPEX.	TMP 2035 https://civitas.eu/tool-inventory https://urban-mobility-observatory.transport.ec.europa.eu/index_en Expert judgment.
Total	5,000,000	975,000,000	242,900,000		

ACTION 14

Develop micro-mobility infrastructure across Bursa

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Developing a Micro-Mobility Masterplan.	200,000	-	-	-	Expert judgment.
Component 2: Micro-mobility infrastructure development	-	13,200,000	264,000	Assuming 55km of new bike lanes at €200k per km. Assuming 250 bikes/scooters at €8,000 per unit. OPEX assumed at 0.2% of CAPEX.	Expert judgment. GCAP Gaziantep and Istanbul. https://dergipark.org.tr/tr/download/article-file/911762
Component 3: Micro-mobility awareness raising campaign	25,000	-	-	-	Expert judgment.
Total	225,000	13,200,000	264,000		

ACTION 15

Transition to a low-emission bus fleet with supporting infrastructure

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Low-emission bus fleet	125,000	35,200,000	8,800,000	Project preparation (feasibility, due diligence, site selection, etc.). Assuming 88 buses at €400k each. OPEX assumed at 5% of CAPEX.	Expert judgment. GCAP Gaziantep and Istanbul.
Component 2: EV Charging stations and refuelling infrastructure	200,000	6,000,000	600,000	Project preparation (feasibility, due diligence, site selection, etc.). Assuming 2 stations at €3 million each. OPEX assumed at 2% of CAPEX.	Expert judgment. EGO CNG Bus Project.
Component 3: BRT lanes	200,000	39,000,000	3,900,000	Project preparation (feasibility, due diligence, site selection, etc.). Assuming 13 km of BRT lanes at around €3 million per km. OPEX assumed at 2% of CAPEX.	Expert judgment based on comparison against similar context. https://brtdata.org/indicators/systems/capital_cost_per_kilometer_us_million_per_km
Total	525,000	80,200,000	13,300,000		

ACTION 16

Enhance operations of the transportation system through smart interventions

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Implementing Smart Transportation System with various smart solutions	250,000	5,250,000	-	Project preparation (feasibility, due diligence, site selection, etc.) Pilot the implementation of 35 smart intersections at around €150k each.	GCAP Istanbul. Critical intersection points: https://www.bursa.bel.tr/haber/bursanin-trafik-cozumlerine-aklin-yolu-odulu-32958 Samsung example: https://www.samsunhaber.com/tartismali-eds-sisteminin-maliyeti-dudak-ucuklatiyor
Component 2: Develop the Integrated Traffic Management Centre		500,000	550,000	Staffing costs (Assumed average yearly salary of an employee in Türkiye of around €12k). OPEX assumed at 10% of CAPEX.	Expert judgment.
Component 3: Expanding BursaKart coverage	100,000		-	Including system integration, survey upgrades, any necessary software costs.	Expert judgment.
Total	350,000	5,750,000	550,000		

ACTION 17

Ensure sustainable water use in green spaces

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Project preparation (feasibility, due diligence, site selection, etc.).	200,000	-	-	-	Expert judgment.
Design and implementation of smart irrigation systems	-	784,000	39,200	Assumed 300 ha of smart irrigation systems at around €2.8k for design and implementation. OPEX assumed as 1% of CAPEX	Expert judgment. https://www.tarimorman.gov.tr/SYGM/Belgeler/Su%20Kaynaklar%C4%B1%20%C4%B0klm%20Proje/Nihal%20Rapor.pdf
Total	200,000	784,000	39,200		

ACTION 18

Implement use of alternative water sources in buildings

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Implement a programme for deploying water harvesting and reuse systems in existing and planned municipal and public buildings	80,000	1,160,000	58,000	Project preparation (feasibility, due diligence, site selection, etc.). Assuming 10 buildings with a roof area of around 30k m² at a cost of €116k each. OPEX assumed at 5% of CAPEX.	Expert judgment. Feasibility Analyses of Alternative Water Resources in Türkiye: Rainwater Harvesting, Greywater Reuse, Istanbul Technical University, Department of Environmental Engineering, 2024.
Component 2: Implement a programme for deploying rainwater harvesting in large commercial and industrial buildings.	50,000	300,000	15,000	Project preparation (feasibility, due diligence, site selection, etc.). Assuming 10 buildings with a roof area for around 15k m² at a cost of €30k each. OPEX assumed at 5% of CAPEX.	Expert judgment. Feasibility Analyses of Alternative Water Resources in Türkiye: Rainwater Harvesting, Greywater Reuse, Istanbul Technical University, Department of Environmental Engineering, 2024.
Component 3: Develop a Market Study for Alternative Water Uses.	200,000	-	-		Expert judgment.
Total	330,000	1,460,000	73,000		

ACTION 19

Ensure sustainable use of water resources in rural districts

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Develop a Bursa Province NRW strategy and Drought Management Plan.	550,000	-	-	-	Expert judgment.
Component 2: Implement a targeted programme to reduce NRW in areas where it is highest.	-	15,000,000	-	Includes equipment and materials, such as, smart meters and related communication infrastructure, pressure and leak monitoring equipment, valves, pipe repair. Includes labour cost.	Based on previous studies of ISKI and BUSKI
Component 3: Implement smart irrigation and selection of sustainable crop patterns for farms.	-	21,875,000	1,100,000	Assuming conversion of 8,750 ha of current flood irrigation land to use smart irrigation at a cost of around €2.5k per ha. OPEX assumed at 1% of CAPEX.	https://www.okdecoracion.com/outdoor-living-design/smart-gardening-landscaping/smart-irrigation-system-costs-what-youll-actually-pay-in-2024/ https://www.okdecoracion.com/outdoor-living-design/smart-gardening-landscaping/smart-irrigation-system-costs-what-youll-actually-pay-in-2024/
Total	550,000	36,875,000	1,100,000		

ACTION 20

Implement planned upgrades to municipal wastewater treatment plants

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Develop a Wastewater Treatment and Bioresource Strategy.	250,000	-	-	-	Expert judgment.
Component 2: Project preparation (feasibility, due diligence, site selection, etc.)	500,000	-	-	-	Expert judgment.
Eastern WWTP capacity increase	-	18,000,000	1,800,000	OPEX assumed at 10% of CAPEX. Assuming €225 per m3 of capacity.	https://yesilosb.sanayi.gov.tr/projedokumanlari
Western WWTP capacity increase	-	19,687,500	1,968,750	OPEX assumed at 10% of CAPEX.	As above.
Tirilye WWTP	-	900,000	90,000	OPEX assumed at 10% of CAPEX.	As above.
Nilüfer WWTP	-	2,700,000	270,000	OPEX assumed at 10% of CAPEX.	As above.
Kucuk Kumla WWTP	-	1,502,775	150,277	OPEX assumed at 10% of CAPEX.	As above.
Kursunlu WWTP	-	2,250,000	225,000	OPEX assumed at 10% of CAPEX.	As above.
Akcalar WWTP	-	1,026,225	102,622	OPEX assumed at 10% of CAPEX.	As above.
Karacabey WWTP	-	1,912,500	191,250	OPEX assumed at 10% of CAPEX.	As above.
Inegöl WWTP	-	29,250,000	2,925,000	OPEX assumed at 10% of CAPEX.	As above.
Total	750,000	77,229,000	7,722,900		

ACTION 21

Increase capacity within the Energy Efficiency Centre

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Cost of new and upgraded equipment e.g. PCs, software etc.	-	100,000	-	-	Expert judgement.
Cost of admin staff	-	-	120,000	Staffing costs (Assumed average yearly salary of an employee in Türkiye of around €12k).	Expert judgement.
Cost of technical staff/consultants	-	-	375,000	Staffing costs (Assumed average yearly salary of an employee in Türkiye of around €12k).	Expert judgement.
Total	-	100,000	495,000		

ACTION 22

Establish a heat recovery plant and district heating network

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Retrofitting the Ovaakça Natural Gas Combined Cycle Power Plant to harness heat energy	250,000	7,000,000	700,000	Assumed at single capital cost.	Expert judgement.
Component 2: Developing a district heating network	250,000	18,000,000	1,800,000	Assumed 15.4 km at cost of around €900k per km.	Expert judgement. Uni of Strathclyde study: https://www.esru.strath.ac.uk/EandE/Web_sites/11-12/District_heating_from_wind/financialoverview.html
Total	500,000	25,000,000	2,500,000		

ACTION 23

Expand biogas production capacity

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Expansion of biogas production at the existing Eastern Region Integrated Solid Waste Disposal Facility and facilitating biomethane production.	250,000	148,850,000	14,885,000	Assumed at single capital cost for a new anaerobic digestion facility on site. Does not include costs for land or processing units before the digestion plant (e.g. de-packaging, hammer mills or feed blending). OPEX assumed at 2% of CAPEX.	Expert judgment. Based on past AtkinsRéalis projects.
Component 2: Establish an organic waste collection unit	-	1,150,000	115,000	Assuming 5 new waste collection vehicles at €230k each. OPEX assumed at 2% of CAPEX.	Expert judgment. https://www.trashrite.com/blogs/news/how-much-does-a-garbage-truck-cost-pricing-types-and-considerations
Total	250,000	150,000,000	15,000,000		

ACTION 24

Develop a floating solar farm

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Floating Solar Farm.	500,000	7,600,000	760,000	Project preparation (feasibility, due diligence, site selection, etc.). Assumed at single capital cost for a 10MW floating solar farm at €760k per MW. OPEX assumed at 2% of CAPEX.	Expert judgment. https://www.ebrd.com/home/work-with-us/projects/psd/51908.html#customtab-eae5b1e77f-item-9e0ac55478-tab
Component 2: Feasibility Study for a large-scale battery storage plant.	200,000			-	Expert judgment.
Component 3: Renewable Energy Plants on BMM-owned land opportunities study.	200,000			-	Expert judgment.
Total	900,000	7,600,000	760,000		

ACTION 25

Improve performance through digital and governance initiatives

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Establishing a Waste Task force			25,000	-	Expert judgment.
Component 2: Digital Solid Waste Management Platform		115,000	170,000	Build out of digital platform. Server and network infrastructure average between \$5k - \$20k. OPEX assumes staffing cost to manage digital platform and collect data ((Assumed average yearly salary of an employee in Türkiye of around €12k), and maintenance and operation.	Expert judgment. https://blog.servermania.com/database-hosting-cost
Component 3: Strengthen monitoring, reporting and governance	50,000			Includes capacity building.	Expert judgment.
Total	50,000	115,000	195,000		

ACTION 26

Improve waste segregation across the city

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Fund 10,000 new bins for source-separation	200,000	4,000,000	-	Assuming 10,000 bins at around €400 each.	https://www.thepricer.org/how-much-does-a-recycling-bin-cost/
Component 2: Funding 50 mobile waste collection centres and 10 site-based collection centres	-	2,307,500	-	Assuming 50 mobile waste collection centres at around €3,750 each and 10 site based collection centres at around €212,000 each.	Based on local market knowledge and research.
Component 3: Funding the purchase of 20 new collection vehicles	-	2,482,500	-	Assuming 20 collection vehicles at around €124k, including the vehicle and any necessary additional equipment.	Based on local market knowledge and research.
Component 4: Develop and carry out wide-reaching awareness-raising activities	25,000	-	-	-	Expert judgment.
				OPEX assumed at 5% of CAPEX.	
Staffing cost and maintenance	-	1,080,000	2,470,000	Assuming 50 staff for waste collection sites at 5 per site and 60 staff for waste collection vehicles at 3 per vehicle (€12k yearly salary).	Expert judgment.
Total	225,000	9,870,000	2,470,000		

ACTION 27

Enhance capacity and efficiency of waste transfer station network

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Project preparation (feasibility, due diligence, site selection, etc.).	400,000	-	-	-	Expert judgment.
Transfer site development costs.	-	1,237,500	-	Assuming 3 sites at a cost of around €412 k each. Included construction, mechanical and electrical work. Excludes land acquisition costs.	Based on local market knowledge and research.
New sliding floor semi-trailer trucks.	-	232,500	-	Assuming 3 vehicles at around €77.5k each.	Based on local market knowledge and research.
				OPEX assumed at 5% of CAPEX costs.	
Staffing and maintenance costs.	-	-	2,170,000	Assuming 10 staff per site for 3 sites (€12k yearly salary).	Expert judgment.
Total	400,000	1,470,000	2,170,000		

ACTION 28

Implement the Western Region Integrated Solid Waste Disposal Facility

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Development of new Western Integrated Solid Waste Disposal (Management) Facility.	400,000	200,600,000	54,350,000	Assumed at single capital cost for a new Integrated site including was segregation plant, biometanisation plant, landfill, energy production from landfill gas. Excludes costs for land acquisition. OPEX assumed at 5% of CAPEX. Assuming 70 staff needed to run the new facility (€12k yearly salary).	Based on local market knowledge and research and Bursa Solid Waste Management Plan.
Component 2: Transition plan for the existing Yenikent Solid Waste Landfill.	200,000	-	-	-	Expert judgment.
Total	600,000	200,600,000	54,350,000		

ACTION 29

Develop a digital dashboard for air, noise, water and soil quality monitoring

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Enhancing environmental data monitoring	50,000	90,000	175,000	Includes, study to identify locations of enhanced environmental monitoring, installation of 10 new air quality monitoring units at around €9 k each, and OPEX for regular monitoring and annual reporting.	Expert judgment. https://aqicn.org/products/monitoring-stations/
Component 2: Developing an environmental data digital dashboard	-	265,000	-	Build out of digital platform. Server and network infrastructure average between \$5k - \$20k.	Expert judgment. https://blog.servermania.com/database-hosting-cost .
Total	50,000	355,000	175,000		

ACTION 30

Develop a 'River Depollution Roadmap' for the Nilüfer Stream

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Development of the 'River Depollution Roadmap'	300,000	-	-	-	Expert judgment.
Total	300,000	-	-		

ACTION 31

Develop a Heat Action Plan

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Development of the 'Heat Action Plan'	300,000	-	-	-	Expert judgment.
Total	300,000	-	-		

ACTION 32

Implement nature-based solutions along urban rivers

Component	Development / Advisory (€)	CAPEX (€)	OPEX over 5 years (€)	Comment	Source
Component 1: Development of an Opportunities Study	250,000	-	-	-	Expert judgment.
Component 2: Pilot river re-naturalisation and green infrastructure implementation	450,000	3,210,000	321,000	River re-naturalisation and hydraulic restoration of 2km at around €30 k per km. Assumed 4.5 ha at €700k per ha. OPEX assumed as 2% of CAPEX.	Expert judgment. https://publications.parliament.uk/pa/cm201011/cmselect/cmcomloc/writev/regeneration/m65.htm https://www.therrc.co.uk/assets/files/Conference/2022/Presentations/rrc_keynote_2022_final2_david_sear.pdf
Total	700,000	3,210,000	321,000		

Appendix B

GHG Emissions Reductions Calculations

This note provides an overview of the approach taken to determine GHG emissions reductions associated with individual Green City Actions. Actions were first qualitatively assessed to identify whether GHG emissions reductions. As a result:

- 11 Actions were identified resulting in direct GHG emissions reduction with the possibility of calculating this reduction using proxies and existing GHG emissions data;
- A further 5 Actions were identified resulting in direct GHG emissions reduction, however, due to a lack of sufficient detail, or proxies, emissions reduction were not possible to reliably calculate.
- 12 Actions were identified resulting in indirect GHG emissions reduction, similarly due to a lack of data and proxies, reductions could not be calculated; and
- 4 Actions were identified as having no impact on GHG emissions reductions.

GHG emission reductions for the 11 Actions with direct impact were calculated using assumptions based on context-relevant, publicly-available data. Where available, data from existing BMM strategies and plans (e.g., 2017 Bursa Climate Action Plan, TMP 2035) were used for calculations, supported by global proxy data and assumptions, where necessary. Estimated GHG emissions reductions for all Green City Actions have been validated with Sectoral Stakeholder Groups during technical meetings held 20-22 May 2025. Total GHG emissions reductions of the Actions are indicative and subject to refinement as further data becomes available or Action designs are finalised

The following table outlines assumptions and calculation approaches used for calculating GHG emissions reductions for the 11 Green City Actions ascertained as having direct impacts.

ID	Action Title	Carbon saving per annum (tCO ₂ e)
Buildings		
8	Implement sustainability and resilience interventions in BMM-owned buildings.	• As per the Bursa Sustainable Energy and Climate Change Adaptation Plan Monitoring and Evaluation report (2020), emissions from Municipal owned buildings were 103,754 tCO₂e/year. • It was assumed this action could reduce by 1/3rd based on the Atkins Realis Carbon Insights tool as well as evidence showing improved insulation can result in energy losses of around 30% (https://powertoswitch.co.uk/energy-efficiency/where-does-all-the-heat-go/#:~:text=About%2035%25%20of%20the%20heat,energy%20efficient%20has%20many%20benefits.) • Therefore, it is estimated 31,100 tCO₂e/year savings could be achieved.
9	Deploy a low-emissions heating programme for residential buildings	• As per the Bursa Sustainable Energy and Climate Change Adaptation Plan Monitoring and Evaluation report (2020), emissions from residential electricity and fuel use were 3,603,839 tCO₂e/year. • Anecdotal evidence suggests the total number of households assumed to be using coal for heating was around 6%, possibly accounting for 68,000 households when calculated using the population of Bursa and average household size in the region. • Therefore, it is estimated 216,200 tCO₂e/year savings could be achieved by providing these households with low-carbon heating alternatives.

ID	Action Title	Carbon saving per annum (tCO ₂ e)
Transport		
13	Expand the metro / light rail network	- The TMP 2035 assumes that the M4 Metro Line could save around 105 million car trips a year when fully implemented. - Based on the average trip distance of around 10.65km and 170 g/CO₂/km, the total CO₂ savings for a single trip could be as high as 0.0018105 tCO₂e. - Therefore, it is estimated that 190,770 tCO₂e/year could be saved as a result of the saved car trips.
14	Develop micro-mobility infrastructure across Bursa	- The TMP 2023 estimates trips by private vehicles account for around 34.5% of total trips in Bursa. 3,169,902 tCO₂e/year as per the Bursa Sustainable Energy and Climate Change Adaptation Plan Monitoring and Evaluation report (2020). - A 94% reduction in CO₂e emissions can be achieved by switching to cycling (16g CO₂e) compared to driving a private vehicle (170g CO₂e) (https://ourworldindata.org/travel-carbon-footprint). - Assuming a 0.5% reduction in private vehicle modal share as people choose active travel options could result in a saving of 43,000 tCO₂e/year.
15	Transition to a low-emission bus fleet with supporting infrastructure	- As per the Bursa Sustainable Energy and Climate Change Adaptation Plan Monitoring and Evaluation report (2020), emissions associated with busses was 70,423 tCO₂e/year. - As per the TMP 2035, all 876 buses in Bursa between 2018 and 2025 were diesel buses; therefore, emissions were around 80.39 tCO₂e/year per bus. - Assuming switching 10% of this fleet (88 buses) to clean electric vehicles could save as much as 7,000 tCO₂e/year.
Water		
19	Ensure sustainable use of water resources in rural districts	- As per the Bursa Sustainable Energy and Climate Change Adaptation Plan Monitoring and Evaluation report (2020), 134,706,809 kWh of electricity is used in agriculture for irrigation. - Assuming 10% of agricultural land is irrigated using drip irrigation rather than flood irrigation could reduce water consumption by 4% and therefore reduce electricity usage associated with treating water. - Applying the UNFCCs Harmonized IFI Default Grid Factors from 2021 for Türkiye of around 0.000309 tCO₂e/kWh to this amount of electricity reduced, could result in savings of around 1,750 tCO₂e/year.
20	Implement planned upgrades to municipal wastewater treatment plants	- The current capacity of wastewater treatment in Bursa is around 780,000 m³/day. - This requires around 569,575,000 kWh/year in electricity assuming 2kWh is required to treat one m³ of wastewater (https://www.mdpi.com/1996-1073/16/5/2433?utm_source=chatgpt.com and https://www.energystar.gov/sites/default/files/tools/DataTrends_Wastewater_20150129.pdf). - Assuming an implementation of energy efficiency technology and clean energy generation, a 50% reduction in energy usage for treatment could be achieved (based on AtkinsRéalis Carbon Insights Tool) - Applying the UNFCCs Harmonized IFI Default Grid Factors from 2021 for Türkiye of around 0.000309 tCO₂e/kWh to this amount of electricity reduced, could result in savings of around 88,000 tCO₂e/year.
Energy		
22	Establish a heat recovery plant and district heating network	- The total heating demand for 10,000 homes is assumed to be around 174,779,550 kWh/year, based on a heating demand of around 170.85 kWh/m²/year and an average house size of around 102.30 m² in the region (https://researchportal.northumbria.ac.uk/ws/portalfiles/portal/126445974/Energy_efficient_building_design_under_climate_change_adaptation_process.pdf, and http://iupress.istanbul.edu.tr/en/journal/iusd/article/turkiyede-konut-sahipligi-konut-kosullari-ve-konut-kalite-endeksi). - Assuming this total heat demand is provided by existing heat as a result of burning natural gas at the Ovaakca Natural Gas Combined Cycle Power Plant, thereby reducing the amount of additional natural gas needed to heat the homes, around 32,300 tCO₂e/year could be saved when applying the carbon intensity of natural gas of around 0.000185 tCO₂e/year (https://www.carbonindependent.org/15.html#:~:text=Natural%20gas&text=Older%20gas%20meters%20measure%20gas,kg%20%2F%20kWh%20%5B9%5D%20).
23	Expand biogas production capacity	- Assuming a new biomethenisation plant is installed with the same capacity of the current plant, this would result in the additional generation of 13,600,000 kWh/year. - Production of this amount of electricity from biogas as opposed to it coming from the Turkish national grid, applying the UNFCCs Harmonized IFI Default Grid Factors from 2021 for Türkiye of around 0.000309 tCO₂e/kWh, could result in savings of around 4,200 tCO₂e/year.
24	Develop a floating solar farm	- A floating solar farm of 10MWh and 200,000 m² in size could possibly generate around 50,400,000 kWh/year under ideal conditions and based on the regional solar irradiance of around 1,400 kWh/m²/year (https://shura.org.tr/wp-content/uploads/2020/04/SHURA-2020-04-Rooftop-Solar-Energy-Potential-in-Buildings.pdf). - Solar energy has an average carbon intensity of around 0.000037 tCO₂e/year (https://www.voltafan.com/index.php/2024/07/25/analysis-of-lifecycle-co2-emissions-from-various-electricity-generation-technologies/). - Therefore, when compared to the carbon intensity of the Turkish National Grid, at around 0.000309 tCO₂e/kWh as per UNFCCs Harmonized IFI Default Grid Factors from 2021), the floating solar farm could save around 13,700 tCO₂e/year.
Solid Waste		
28	Implement the Western Regional Integrated Solid Waste Disposal Facility	- As per the Bursa Sustainable Energy and Climate Change Adaptation Plan Monitoring and Evaluation report (2020), emissions as a result of the solid waste sector were 90,313 tCO₂e/year. - It is assumed that implementing the new Western Regional Integrated Solid Waste Management Disposal Facility could result in the reduction of solid waste reaching landfill by around 39%, similarly to the Eastern facility. - Therefore, it is estimated around 35,000 tCO₂e/year savings could be achieved.

Appendix C

Overview of NCV Methodology

This note provides an overview of the methodology undertaken for the Natural Capital Valuation (NCV) assessment carried out as part of this assignment. It describes the methodology for the estimation of the baseline NCV for Bursa, the valuation of natural capital benefits from implementing selected individual Green City Actions, and associated apportionment of NCV benefits across sectors, and describes an alternative method for estimating the natural capital benefits of Green City Actions.

1. Baseline NCV estimates for Bursa

A Natural Capital Valuation (NCV) Assessment was undertaken using the EBRD's NCV Approach as part of the Technical Baseline Assessment to evaluate the qualitative, quantitative, and, where possible, monetary value of existing natural assets across Bursa.

Determining the extent of ecosystem types in Bursa

The extent of ecosystem types across Bursa was sourced from the Copernicus land cover dataset (the most up to date dataset from 2019). As the Copernicus dataset did not include urban greenspace as an ecosystem type category, Open Street Map (OSM) data was used to determine the extent of urban greenspace within Bursa's urban districts only. To account for the marine ecosystem, a coastal area was calculated based on one tenth of a 250m buffer of the Bursa coastline.

Sourcing ecosystem service values

Monetary values were sourced for the water supply, global climate regulation, water quality regulation, recreation, flood regulation, fish provisioning, and crop provisioning ecosystem services which

were deemed the most important to Bursa. Where possible, local values from Türkiye were used to be more representative of local conditions. However, the most suitable proxies from other countries were used in absence of local data (see Table C-1).

Adjusting and applying the ecosystem service values

Ecosystem service values sourced were uplifted from their respective reference years to the assessment year (2024). If the value was sourced internationally, the PPP conversion rate was used to convert to TRY first before inflating to 2024 prices. For the reporting of values in the EBRD NCV Approach, TRY values were then converted to EUR. The areas of each ecosystem type were then multiplied by the EUR ecosystem service values to generate NCV in annual and present value terms. The present values were calculated using a range of parameter values for discount rate and assessment period as per EBRD's NCV approach.

Ecosystem Service	Ecosystem Type	Value source and reference price year	Source currency
Water supply	Water	Buski Gov – 2023 price year	TRY
Global climate regulation	Urban Greenspace	Xu and Zhao (2021) – 2021 price year	CNY
Global climate regulation	Forest	Uzel and Gurluk (2023) – 2023 price year	TRY
Water quality regulation	Wetlands	Morris and Camino (2011) – 2010 price year	GBP
Recreation	Water/Wetland	Gurluk and Rehber (2008) – 2004 price year	TRY
Recreation	Forest	Uzel and Gurluk (2023) – 2023 price year	GBP
Recreation	Urban greenspace	Xu and Zhao (2021) – 2021 price year	CNY
Flood regulation	Forest	Broadmeadow et al. (2023) – 2021 price year	GBP
Flood regulation	Wetlands	Morris and Camino (2011) – 2010 price year	GBP
Flood regulation	Urban Greenspace	Zhang et al. (2012) – 2009 price year	CNY
Fish provisioning	Water	Selina Wamucii - 2023 price year	TRY
Crop provisioning	Fruit	Turkiye İstatistik Kurumu – 2021 price year	TRY
Crop provisioning	Veg	Turkiye İstatistik Kurumu – 2021 price year	TRY
Crop provisioning	Cereal	Turkiye İstatistik Kurumu – 2021 price year	TRY

Table C-1 - Ecosystem service value sources used in NCV assessment

2. NCV impact estimation for individual Green City Actions - action-based approach

The revised methodology for Part C of the NCV approach involved estimating the NCV of individual Green City Actions. This was done using a detailed, bottom-up natural capital approach to value the annual NCV impact of implementing a subset of individual actions and then using these values as a reference point to apportion NCV impacts to the remaining actions with direct NCV impacts. 6 Green City Actions with direct NCV impacts were selected by EBRD for valuation - these Actions were expected to have the largest NCV impacts.

Bottom-up estimation of NCV for selected individual actions

The first steps involved:

- Carrying out a literature review to refine the sources for quantification and valuation of the actions. Where possible, the same sources for valuations of ecosystem services were used as in Part A.
- Setting reasonable assumptions for the change in biophysical indicators for each action (e.g. change

in area of different ecosystem types) based on the action details and locations.

- Applying the monetary values for each ecosystem service to the change in biophysical indicators for each action to estimate the NCV impact of each selected action.

Apportionment of NCV to remaining actions

The relative share of each sector's total NCV impact made up by each action in that sector was estimated. This was based on an informed judgement of the qualitative assessment of Green City Actions undertaken in Part C of the EBRD NCV approach. For instance, actions 13 and 14 were judged to have 50% each of the total NCV impact of the Transport sector actions (see Table C-2).

For sectors which contained at least one action that was valued using the bottom-up approach, this value could act as a reference point to apportion NCV to the other actions in that sector according to the

ID	Action Title	Estimated proportion of sectoral NCV
13	Expand the metro / light rail network	0.5
14	Develop micro-mobility infrastructure across Bursa	0.5
15	Transition to a low-emission bus fleet with supporting infrastructure	0
16	Enhance Smart Transportation System	0

Table C-2 - Relative share of NCV estimated for Transport sector actions

estimated proportions.

For sectors which did not contain an action that was valued using the bottom-up approach, an extra step was required. The average ratio of the total sectoral NCV previously estimated under the sector-based approach (described in Part A) to the total sectoral NCV estimated under the action-based approach (described above) was calculated for the sectors which contained the selected actions. This was then used to scale down the total sectoral NCV impact from the sector-based approach for the remaining sectors. These sectoral values were then divided among the actions within each sector based on the proportions estimated. This allowed for a value to be attributed to each individual action.

Assumptions and limitations of the method

- **This approach involved less** time and effort compared to assessing each individual action in the GCAP using a bottom-up approach. However, there is a greater degree of uncertainty and additional possibility for judgement error from assigning the relative NCV proportions within each sector.
- The 6 selected actions for individual NCV impact estimation were deemed to have the greatest NCV impact. There is therefore, greater uncertainty in the estimated impact for actions that are not deemed as impactful to NCV.
- At this level of analysis, we are abstracting away from the changing profile of biophysical/monetary impacts over time but the NCV impacts of all of the actions should be considered as the annual difference in NCV

relative to the baseline once interventions are fully established.

- The assumptions when assessing each of the 6 individual actions are provided in Table C-3 to provide transparency on decisions made during the assessment. At such an early stage in the action design process, information is limited and so very broad assumptions have to be made. These values should be updated as the actions get refined.
- As not every sector contained one of the actions selected for bottom-up valuation, the previous NCV estimates from the sector-based, top-down approach had to be used to provide a reference point for the remaining sectors. This approach has a much higher degree of uncertainty and so it is recommended in future to select an action in every sector for bottom-up valuation.

Action Name	Sector	Estimated net change in annual NCV	Assumptions
3 - Undertake Urban Redevelopment Projects along planned Metro Line	Land Use	€ 2,319,326	The area included in the NCV assessment is 20% of the area of the Transit Oriented Development (TOD) around the planned metro station. This space was assumed to be all urban land in the baseline which would be enhanced to urban greenspace as part of the action.
4 - Establish Green belts around Organized Industrial Zones (OIZs)	Land Use	€ 2,943,125	The NCV assesses the area for the green buffer intervention after removing areas not viable for the intervention due to land ownership and other constraints. - It was assumed that of the total area, 60% was cropland and 40% urban/vacant land. - It was assumed that the total area for the intervention would be changed to all forest cover for the purposes of this assessment. Classifying as urban greenspace would overestimate values given high values associated with greenspaces in high population density areas. Availability of locally relevant valuations for forests and cropland was greater than for shrubland and so an estimate on appropriate mix was used.
5 - Transform existing industrial area in Kestel or Gürsu Districts	Land Use	€ 1,059,537	The NCV assessments uses the assumed area of industry to be converted to social infrastructure of urban greenspace for this action (based on identified industrial areas). - The baseline is assumed to be urban/vacated land. - It has been assumed the entire assessment area would be enhanced to urban greenspace. - SuDS measures are likely to have a very minimal impact compared to land cover change.
8 - Implement sustainability and resilience interventions in BMM-owned buildings	Buildings	€ 70,636	For this action, the areas assessed within this NCV assessment are the resilience hubs. - It was assumed that the average area of a single resilience hub is 0.02 hectares. Assuming, 100 resilience hubs were planned as part of this action, the total assessment area was 2 hectares of urban/building land cover. - It was assumed that the full area included in the assessment would be enhanced to urban greenspace. - Only landscaping and NBS would have a notable NCV impact. Permeable pavements and rainwater collection is not NCV, and green roofs are challenging to value.
30 - Develop a 'River Depollution Roadmap' for the Nilüfer Stream	Climate & Environment	€ 8,077,548	The area included in the NCV assessment is the assumed 20m buffer area of the length of the river only running through and downstream of Bursa. - It was assumed that of the buffer area, 40% would be cropland and 60% would be urban area in the baseline. - From the 40% cropland baseline area, it was assumed that half of it would be changed to forest and the other half to wetlands. - From the 60% urban baseline area, it was assumed all the area would be improved to urban greenspace.
32 - Implement nature-based solutions along urban rivers	Climate & Environment	€ 987,059	The length of the river of the pilot project assessed for this NCV assessment is 8.7km. It was assumed a buffer area of 20m around the river would be included as part of the action. - As there are no monetary values for in-channel benefits for Türkiye, it was assumed there would be no change in the NCV for the length of the river itself (i.e. no in-channel measures). - The buffer area has been assumed to be urban land cover in the baseline due to the location of the stream (i.e. an urban river). - As a result of the action, it was assumed that 80% of the urban area would be enhanced to urban greenspace and 20% would become wetlands within the buffer area of the urban river.

Table C-3 - Net change of assessed Green City Actions for the revised approach with assumptions

3. Alternative Method for Estimating the Natural Capital Benefits of Green City Actions - sector-based approach

An alternative approach to the bottom-up valuation methodology described above is a top-down approach requiring less data and is less time-intensive. It has a high degree of uncertainty and potential for judgement error as it does not have any bottom-up NCV estimation or external reference point. The percentage changes associated with each qualitative impact rating used to derive the sectoral estimates below have not been externally validated and likely represent a significant overestimate. It is included to show alternative approaches to the challenge of assessing NCV impact at an early design stage but a more detailed, bottom-up approach to natural capital valuation is recommended.

This step of the NCV approach assessed the potential impact of implementation of Green City Actions on the natural capital value in Bursa over the next 50 years, quantifying the NCV increase over the coming 50 years as a result of implementing all of the proposed Green City Actions in each sector (GCAP Scenario) against business as usual (BAU Scenario) where none of these actions would be implemented.

A two-stage process was implemented where the percentage of the total natural capital value affected is estimated for each group of sector actions based on the anticipated scale of impact of the group of actions. This has been implemented to try and account for the varying scale (in geographic terms) of groups of actions. The scale impact boundaries are defined for each of the terms in the table C-4.

We first determined the scale of impact for the group of actions associated with each sector (e.g. 'Complete') and then assigned a sustainability category for each ecosystem service for each sector (e.g. 'Improvement anticipated'). The sustainability categories were determined through a qualitative assessment comparing all the actions in each sector (assuming they are all implemented) against a 'Business As Usual' (BAU) scenario where no actions are implemented. The BAU was determined through a risk assessment undertaken as part of the baseline assessment to qualitatively assess the future impacts on ecosystem services if no actions are implemented. The combination of sustainability category and scale of impact (e.g. 'Improvement anticipated' and 'Partial') results in a defined percentage change in the value of each ecosystem service.

Scale of impact	Geographic area affected
Complete	More than 80% of assessment area (BMM)
Major	Between 50-80% of assessment area
Partial	Between 10-50% of assessment area
Minor	Less than 10% of assessment area

Table C-4 - Scale impact boundaries

Once the percentage change value has been determined, the percentage change value was applied to both the central estimate of the present value of NCV (50-year lifespan and 6% discount rate) from Step A6 and to the annual NCV for each ecosystem service. The values for all ecosystem services were then summed for the sustainable scenarios for each sector, and for the BAU scenario. This was done separately for both the annual NCV and present value of NCV. Comparing the total values for the sustainable scenario for each sector to the total value for the BAU scenario allowed the following type of insights to be generated:

- Present value: “Implementing all of the actions in Sector X will increase natural capital value by \$Y million in present value terms over a 50-year period compared to the BAU scenario. This represents a Z% increase relative to the BAU scenario.”
- Annual value: “Implementing all of the actions in Sector X will increase the annual natural capital value by \$Y per year compared to the BAU scenario. This represents a Z% increase relative to the BAU scenario.”

It should be noted that this approach is an approximation as it does not consider the time profile of natural capital value benefits/dis-benefits over time.

For the purposes of this assessment, it is assumed the actions would be implemented immediately and full benefits/dis-benefits claimed from the first year.

Compared to the BAU scenario, implementing Green City Actions would result in an increase of €488.43 billion (present value terms) in Bursa’s natural capital value over the next 50 years. This equates to an increase of about EUR 30.99 billion on an annual basis over the next 50 years (as shown in Table C-6).

	Percentage change			
	Scale of impact of sector actions			
Sustainability catagory	Complete	Major	Partial	Minor
Significant improvement anticipated	40	20	10	2
Improvement anticipated	20	10	5	1
Neutral	0	0	0	0
Decline anticipated	-20	-10	-5	-1
Significant decline anticipated	-40	-20	-10	-2

Table C-5 - Percentage change against scale of impact of sector actions and sustainability category

Sector	Summary Interpretation	Net Annual Value (compared to BAU)	Total Net Present Value over 50 years (compared to BAU)
Land use	Actions seek to protect, develop and make more accessible natural areas, green spaces and social infrastructure, and to deploy an integrated, transparent, and well-enforced sustainable planning system. Implementing all of the actions in the Land Use Sector is estimated to increase NCV by € 110.32 billion in present value terms over a 50-year period compared to the BAU scenario. Implementing all of the actions in this sector is estimated to increase the annual NCV by € 7.00 billion per year compared to the BAU scenario. This represents a 40% increase relative to the BAU scenario.	€ 7.00 billion ₺ 314.96 billion	€ 110.32 billion ₺ 4,964.33 billion
Water	Actions seek to minimise groundwater, surface water and marine pollution caused by municipal, agricultural and industrial activities and increase the sustainability and resilience of water resources to climate change. Implementing all of the actions in the Water Sector is estimated to increase NCV by € 93.94 billion in present value terms over a 50-year period compared to the BAU scenario. Implementing all of the actions in this sector is estimated to increase the annual NCV by € 5.96 billion per year compared to the BAU scenario. This represents a 34% increase relative to the BAU scenario.	€ 5.96 billion ₺ 268.21 billion	€ 93.94 billion ₺ 4,227.45 billion
Climate & Environment	Actions seek to enhance resilience to the key climate change risks such as extreme heat, drought, flooding, and sea level rise through NbS and to improve monitoring and data collection, sharing and analysis of climate and environment indicators. Implementing all of the actions in the Climate and Environment Sector is estimated to increase NCV by € 83.14 billion in present value terms over a 50-year period compared to the BAU scenario. Implementing all of the actions in this sector is estimated to increase the annual NCV by € 5.27 billion per year compared to the BAU scenario. This represents a 30% increase relative to the BAU scenario.	€ 5.27 billion ₺ 237.37 billion	€ 83.14 billion ₺ 237.37 billion
Transport	Actions seek to accelerate the transition to low-emission and sustainable modes of transport and to improve integration between different transport modes for urban and rural residents that take into account land use and urban growth patterns. Implementing all of the actions in the Transport Sector is estimated to increase NCV by € 81.08 billion in present value terms over a 50-year period compared to the BAU scenario. Implementing all of the actions in this sector is estimated to increase the annual NCV by € 5.14 billion per year compared to the BAU scenario. This represents a 30% increase relative to the BAU scenario.	€ 5.14 billion ₺ 231.47 billion	€ 81.08 billion ₺ 3,648.43 billion

Table C-6 - Contribution to NCV per GCAP Sector using alternative approach

Sector	Summary Interpretation	Net Annual Value (compared to BAU)	Total Net Present Value over 50 years (compared to BAU)
Buildings	Actions seek to implement energy efficiency and resilience measures for buildings and urban transformation projects and to improve monitoring of existing and planned building stock for resilience and energy efficiency throughout the building life cycle. Implementing all of the actions in the Buildings Sector is estimated to increase NCV by € 68.6 billion in present value terms over a 50-year period compared to the BAU scenario. Implementing all of the actions in this sector is estimated to increase the annual NCV by € 4.35 billion per year compared to the BAU scenario. This represents a 25% increase relative to the BAU scenario.	€ 4.35 billion ₺ 195.87 billion	€68.6 billion ₺ 3,087.2 billion
Energy	Actions seek to accelerate the transition to low-carbon energy sources for electricity and heating in all buildings, and to future-proof the electricity generation and distribution network to minimise network losses and improve energy efficiency. Implementing all of the actions in the Energy Sector is estimated to increase NCV by € 51.35 billion in present value terms over a 50-year period compared to the BAU scenario. Implementing all of the actions in this sector is estimated to increase the annual NCV by € 3.26 billion per year compared to the BAU scenario. This represents a 19% increase relative to the BAU scenario.	€ 3.26 billion ₺146.6 billion	€ 51.35 billion ₺2,310.69 billion
Solid Waste	Actions seek to ensure appropriate segregation, treatment and disposal of municipal and industrial solid waste and to improve coordination between different stakeholders for solid waste management. However, implementing all of the actions in the Solid Waste Sector is not expected to have an impact on NCV.	-	-
Industries	Actions seek to reduce environmental pollution from industrial facilities and increase resilience to climate change and economic shocks and to promote efficiency and circular economy principles to minimise resource consumption. However, implementing all of the actions in the Industries Sector is not expected to have an impact on NCV.	-	-
TOTAL		€ 30.99 billion TRY 1,394.48 billion	€ 488.43 billion ₺ 21,979.48 billion



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